

**FRENCH RIVER BASIN
LEICESTER, MASSACHUSETTS**

**STILES RESERVOIR DAM
MA 00983**

**PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM**

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**DEPARTMENT OF THE ARMY
NEW ENGLAND DIVISION, CORPS OF ENGINEERS
WALTHAM, MASS. 02154**

APRIL 1979

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20. ABSTRACT (Continue on reverse side if necessary and identify by block number) The dam is an earthfill dam about 500 ft. long and 29 ft. high. There are deficiencies which must be corrected to assure the continued performance of the dam. Generally the dam is in poor condition. The hazard classification for the dam is high. Severe leakage through the dam in the vicinity of the low-level outlet and upward seepage at the toe near the low level outlet was noted.		



DEPARTMENT OF THE ARMY
NEW ENGLAND DIVISION, CORPS OF ENGINEERS
424 TRAPELO ROAD
WALTHAM, MASSACHUSETTS 02154

REPLY TO
ATTENTION OF:
NEDED

JUN 29 1979

Honorable Edward J. King
Governor of the Commonwealth of
Massachusetts
State House
Boston, Massachusetts 02133

Dear Governor King:

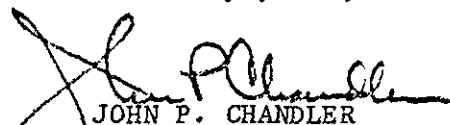
I am forwarding to you a copy of the Stiles Reservoir Dam Phase I Inspection Report, which was prepared under the National Program for Inspection of Non-Federal Dams. This report is presented for your use and is based upon a visual inspection, a review of the past performance and a brief hydrological study of the dam. A brief assessment is included at the beginning of the report. I have approved the report and support the findings and recommendations described in Section 7 and ask that you keep me informed of the actions taken to implement them. This follow-up action is a vitally important part of this program.

A copy of this report has been forwarded to the Department of Environmental Quality Engineering, the cooperating agency for the Commonwealth of Massachusetts. In addition, a copy of the report has also been furnished the owner, Central Water District, 14 Park Avenue, Worcester, Massachusetts 01069, ATTN: Mr. Raymond Shea, President.

Copies of this report will be made available to the public, upon request, by this office under the Freedom of Information Act. In the case of this report the release date will be thirty days from the date of this letter.

I wish to take this opportunity to thank you and the Department of Environmental Quality Engineering for your cooperation in carrying out this program.

Sincerely yours,


JOHN P. CHANDLER
Colonel, Corps of Engineers
Division Engineer

Incl
As stated

STILES RESERVOIR DAM

MA 00983

FRENCH RIVER BASIN
LEICESTER, MASSACHUSETTS

PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION
PROGRAM

NATIONAL DAM INSPECTION
PROGRAM

PHASE I INSPECTION REPORT

BRIEF ASSESSMENT

Identification No.: MA00983

Name of Dam: Stiles Reservoir Dam

Town: Leicester

County and State: Worcester County, Massachusetts

Stream: Bartons Brook - Tributary of the French River

Date of Inspection: November 16, 1978

Stiles Reservoir Dam is an earthfill dam about 500 feet long and 29 feet high. The upstream and downstream slopes are 1-1/4:1 and 2:1 (horizontal to vertical), respectively. A downstream stepped-stone masonry wall, which is part of the original dam structure, is incorporated within the downstream embankment. The spillway weir, which is 50 feet long, consists of a short ogee section with a stepped cascade. The discharge channel is partially riprapped and covered with brush and boulders. Two outlets exist at the dam; one is a 60-inch diameter flood control outlet installed after the 1955 flood, and the other is a 24-inch diameter low-level outlet.

There are deficiencies which must be corrected to assure the continued performance of this dam. This conclusion is based upon a visual inspection at the site, available engineering data, and limited evidence of operational and maintenance procedures. Generally, the dam is in poor condition. According to the Corps of Engineers' guidelines on classification of hazard potential, the dam has been placed in the "high" hazard category.

The following are visible signs of distress which indicate a potential hazard at the site: severe leakage through the dam in the vicinity of the low-level outlet; upward seepage at the toe near the low-level outlet; leak between the side wall and fill at

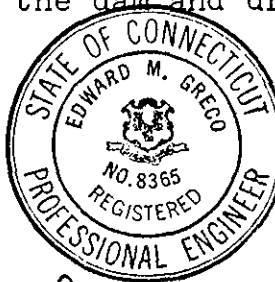
STILES RESERVOIR DAM

the spillway south abutment; leak beneath the 60-inch diameter outlet. Also, a possible seepage zone within the downstream area of the north abutment of the dam should be investigated.

Hydraulic analyses indicate that the spillway and floodgate at the dam can discharge a flow of 1,730 cfs with the water surface at El 845.6, which is the low point on the crest of the dam. An outflow test flood (full probable maximum flood) of 2,970 cfs at El 846.4 will overtop the dam by about 0.8 feet. The spillway and 60-inch outlet can discharge 58 percent of the test flood without overtopping the dam. Spillway discharge alone with water at El 845.6 is 1,370 cfs or 46 percent of the test flood.

It is recommended that the Owner employ the services of a qualified consultant to evaluate the severe leakage that is occurring at the dam as well as the possible seepage area. The consultant should also perform a detailed hydraulic/hydrologic analysis to evaluate the spillway capacity. In addition, the Owner should clear the dam of all trees and brush to at least 50 feet downstream of the toe. The low-level outlet should be repaired and made operable. After the evaluation, the leakage should be repaired. The joints within the 60-inch diameter outlet should be monitored for evidence of movement and repaired or further evaluated. All holes on the crest of the dam should be filled. The Owner should also implement a systematic program of inspection and maintenance.

The recommendations and remedial measures outlined above and in Section 7 should be implemented by the Owner within a period of one year after receipt of this Phase I Inspection Report. In the interim, the 60-inch outlet should immediately be opened and the reservoir drained to the elevation of the invert (El 835.2). An alternative to these recommendations would be to breach the dam and drain the pond.



Edward M. Greco
Edward M. Greco, P.E.
Project Manager
Metcalf & Eddy, Inc.

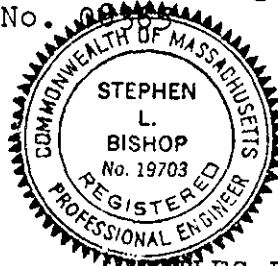
Approved by:

Stephen L. Bishop
Stephen L. Bishop, P.E.
Vice President

Metcalf & Eddy, Inc.

Massachusetts Registration
No. 19703

Connecticut Registration
No. 8365



STILES RESERVOIR DAM

This Phase I Inspection Report on Stiles Reservoir Dam has been reviewed by the undersigned Review Board members. In our opinion, the reported findings, conclusions, and recommendations are consistent with the Recommended Guidelines for Safety Inspection of Dams, and with good engineering judgment and practice, and is hereby submitted for approval.

Joseph A. McElroy

JOSEPH A. MCELROY, MEMBER
Foundation & Materials Branch
Engineering Division

Carney M. Terzian

CARNEY M. TERZIAN, MEMBER
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Joseph W. Finegan, Jr.

JOSEPH W. FINEGAN, JR., CHAIRMAN
Chief, Reservoir Control Center
Water Control Branch
Engineering Division

APPROVAL RECOMMENDED:

Joe B. Fryar

JOE B. FRYAR
Chief, Engineering Division

PREFACE

This report is prepared under guidance contained in Recommended Guidelines for Safety Inspection of Dams, for a Phase I Investigation. Copies of these guidelines may be obtained from the Office of Chief of Engineers, Washington, D.C. 20314. The purpose of a Phase I Investigation is to identify expeditiously those dams which may pose hazards to human life or property. The assessment of the general condition of the dam is based upon available data and visual inspections. Detailed investigations, and analyses involving topographic mapping, subsurface investigations, testing, and detailed computational evaluations are beyond the scope of a Phase I investigation; however, the investigation is intended to identify any need for such studies.

In reviewing this report, it should be realized that the reported condition of the dam is based on observations of field conditions at the time of inspection along with data available to the inspection team. In cases where the reservoir was lowered or drained prior to inspection, such action, while improving the stability and safety of the dam, removes the normal load on the structure and may obscure certain conditions which might otherwise be detectable if inspected under the normal operating environment of the structure.

It is important to note that the condition of a dam depends on numerous and constantly changing internal and external conditions, and is evolutionary in nature. It would be incorrect to assume that the present condition of the dam will continue to represent the condition of the dam at some point in the future. Only through continued care and inspection can there be any chance that unsafe conditions be detected.

Phase I inspections are not intended to provide detailed hydrologic and hydraulic analyses. In accordance with the established Guidelines, the Spillway Test Flood is based on the estimated "Probable Maximum Flood" for the region (greatest reasonably possible storm runoff), or fractions thereof. Because of the magnitude and rarity of such a storm event, a finding that a spillway will not pass the test flood should not be interpreted as necessarily posing a highly inadequate condition. The test flood provides a measure of relative spillway capacity and serves as an aid in determining the need for more detailed hydrologic and hydraulic studies, considering the size of the dam, its general conditions and the downstream damage potential.

STILES RESERVOIR DAM

TABLE OF CONTENTS

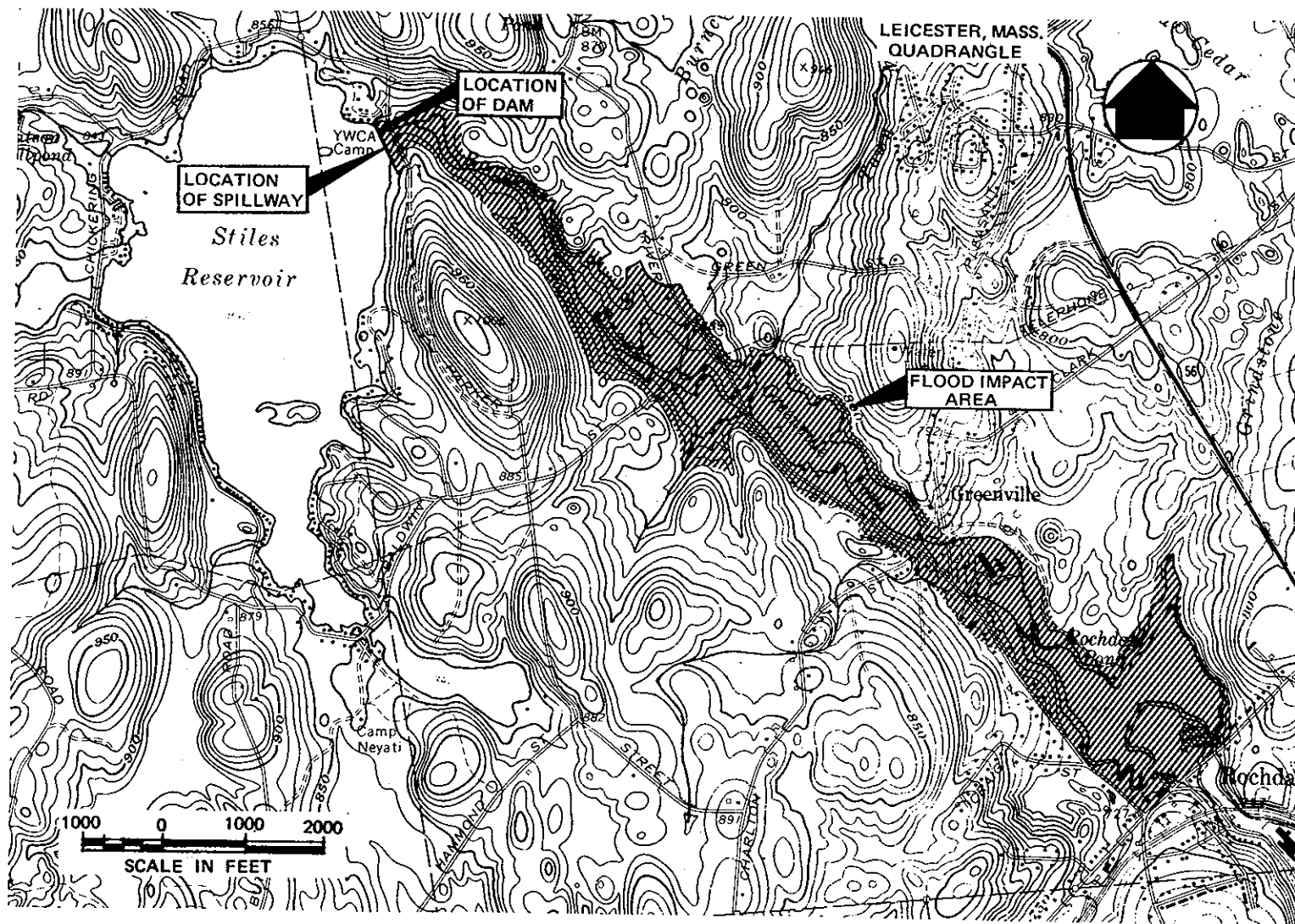
	<u>Page</u>
BRIEF ASSESSMENT	
PREFACE	
OVERVIEW PHOTO	iii
LOCATION MAP	iv
REPORT	
SECTION 1 - PROJECT INFORMATION	1
1.1 General	1
1.2 Description of Project	1
1.3 Pertinent Data	5
SECTION 2 - ENGINEERING DATA	9
2.1 General	9
2.2 Construction Records	9
2.3 Operating Records	9
2.4 Evaluation	10
SECTION 3 - VISUAL INSPECTION	11
3.1 Findings	11
3.2 Evaluation	13
SECTION 4 - OPERATING PROCEDURES	14
4.1 Procedures	14
4.2 Maintenance of Dam	14
4.3 Maintenance of Operating Facilities	14
4.4 Description of Any Warning System in Effect	14
4.5 Evaluation	14
SECTION 5 - HYDRAULIC/HYDROLOGIC	15
5.1 Evaluation of Features	15

TABLE OF CONTENTS (Continued)

	<u>Page</u>
SECTION 6 - STRUCTURAL STABILITY	18
6.1 Evaluation of Structural Stability	18
SECTION 7 - ASSESSMENT, RECOMMENDATIONS, AND REMEDIAL MEASURES	20
7.1 Dam Assessment	20
7.2 Recommendations	21
7.3 Remedial Measures	21
7.4 Alternatives	22
APPENDIXES	
APPENDIX A - PERIODIC INSPECTION CHECKLIST	
APPENDIX B - PLANS OF DAM AND PREVIOUS INSPECTION REPORTS	
APPENDIX C - PHOTOGRAPHS	
APPENDIX D - HYDROLOGIC AND HYDRAULIC COMPUTATIONS	
APPENDIX E - INFORMATION AS CONTAINED IN THE NATIONAL INVENTORY OF DAMS	

**OVERVIEW
STILES RESERVOIR DAM
LEICESTER, MASSACHUSETTS**





LOCATION MAP - STILES RESERVOIR DAM

NATIONAL DAM INSPECTION
PROGRAM

PHASE I INSPECTION REPORT

STILES RESERVOIR DAM

SECTION 1

PROJECT INFORMATION

1.1 General

- a. Authority. Public Law 92-367, August 8, 1972, authorized the Secretary of the Army, through the Corps of Engineers, to initiate a national program of dam inspection throughout the United States. The New England Division of the Corps of Engineers has been assigned the responsibility of supervising the inspection of dams within the New England Region. Metcalf & Eddy, Inc. has been retained by the New England Division to inspect and report on selected dams in the State of Massachusetts. Contract No. DACW 33-79-C-0016, dated November 28, 1978, has been assigned by the Corps of Engineers for this work.
- b. Purpose:
 - (1) Perform technical inspection and evaluation of non-Federal dams to identify conditions which threaten the public safety and thus permit correction in a timely manner by non-Federal interests.
 - (2) Encourage and assist the States to initiate quickly effective dam safety programs for non-Federal dams.
 - (3) Update, verify and complete the National Inventory of Dams.

1.2 Description of Project

- a. Location. The dam is located on Bartons Brook, a tributary of the French River, in the Town of Leicester, Worcester County, Massachusetts (see Location Map).

STILES RESERVOIR DAM

- b. Description of Dam and Appurtenances. Stiles Reservoir Dam consists of an earthfill dam about 500 feet long and 29 feet high (see Figures B-1 and B-2). The upstream and downstream faces are sloped about 1-1/4:1 (horizontal to vertical) upstream and 2:1 downstream. Drawings and records of past correspondence available at the Worcester County Engineering Department indicate that the original downstream stepped-stone masonry wall has been incorporated in the present embankment. The crest of the dam averages 15 feet wide with an average elevation (El) about 846.0. The upstream slope has riprap protection. The abutments of the dam tie into natural ground at each end.

The spillway, located at the south end of the dam, is ungated, without flashboards and consists of a 50-foot wide short ogee-type crest which discharges to a stepped cascade. The spillway crest is at El 842.0 while the streambed at the spillway is at El 831.0. The discharge channel, which is stone lined, directs the flow to a natural streambed which extends through a 4-1/2-foot by 11-foot box culvert and two 5-foot reinforced concrete pipe culverts under a private gravel road.

There are two outlets within the dam. The first outlet consists of a steel sluice gate controlling discharge through a 60-inch diameter concrete pipe. The gate-operating mechanism is housed in a locked structure. The outlet discharges into the downstream spillway channel, which is south of the spillway and was constructed shortly after the 1955 storm.

A second outlet, which is the low-level outlet, consists of a 24-inch diameter pipe. The original 24-inch pipe ended at the stepped stone wall within the embankment and was later extended by installing a 24-inch diameter corrugated metal pipe. The low-level outlet now terminates at a stone head-wall at the toe of the downstream embankment. The invert of the low-level outlet at the discharge end is about at El 817.0. The outlet gate-operating mechanism is housed in a locked gate house.

Drawings, available at the Worcester County Engineering Department, as well as past inspection reports indicate that 12-inch diameter perforated toe drains were installed when the downstream embankment was extended over the masonry wall. Outlets to these pipes are visible at the headwall for the low-level outlet.

Four drawings, which were obtained from the Worcester County Engineering Department, are included in Appendix B. These drawings, dated June, 1957, and April, 1959, show plans of the original dam with downstream stepped-stone wall as well as proposed repairs to the dam.

- c. Size Classification. Stiles Reservoir Dam is classified in the "intermediate" category since it has a maximum height of 29 feet and a maximum storage capacity of 3,100 acre-feet.
- d. Hazard Classification. Although the immediate downstream area of the dam along Pine Street and River Street is sparsely populated, most of the residents along River Street would be effected by a failure of the dam. Further downstream, the villages of Greenville and Rochdale could also be impacted. Were the dam to fail, numerous lives could be lost and significant property damage would occur. Accordingly, the dam has been placed in the "high" hazard category.
- e. Ownership. The dam is owned by the Central Water District, a private utility company, 44 Park Avenue, Worcester, Massachusetts 01609. Mr. Raymond Shea, President (617-752-5416), gave permission to inspect the dam.
- f. Operators. The dam is operated by personnel of the Central Water District. The flood outlet at the spillway can be opened by a hand crank located at the abutment of the spillway. The mechanism is located within a locked structure. The low-level outlet has apparently not been operated in recent years and is assumed inoperable. Moreover, access to the operating

STILES RESERVOIR DAM

stand is over a wood platform in poor condition. The mechanism is also housed in a locked structure, which is on the crest of the dam.

- g. Purpose of Dam. Water is stored in Stiles Reservoir to provide process water for Rochdale Mill which is also owned by the Central Water District. Local residents and campers at a YWCA camp also use the reservoir for recreational purposes.
- h. Design and Construction History. Available records did not indicate the exact date of construction. The owner stated the dam was constructed between 1863 and 1865. Past inspection reports mention reconstruction work in 1887. Drawings (three sheets) dated June, 1957, show a plan of repairs to Stiles Reservoir Dam. These drawings show proposed repairs to the spillway embankment and addition of a toe drain. A second drawing dated April, 1958, shows revisions and also includes a proposed 60-inch outlet. No other plans and records are available on the design and construction of the dam.

Past inspection records dating back to 1923, which were reviewed at the Worcester County Engineering Department, indicate a history of leaks at the dam. Correspondence ordering repairs at the dam was also examined. At one time during 1956, emergency repairs were made to the spillway by the U.S. Army Corps of Engineers. Guillio Construction Company reportedly reconstructed the downstream slope in 1957 and also extended the 24-inch diameter low-level outlet pipe.

Further, the Owner stated that when leaks occurred in the dam, they had been repaired by grouting. No specific information is available on this grouting.

- i. Normal Operating Procedures. The dam is maintained by personnel of the Central Water District. Weekly visits are made to the dam according to the owner. During the winter, the reservoir is reportedly lowered about 3 feet below the spillway crest in preparation for the high spring runoff.

STILES RESERVOIR DAM

1.3 Pertinent Data

- a. Drainage Area. The approximately 2,880 acre (4.5 square mile) drainage area includes numerous swamps and brooks in both Spencer and Leicester, Massachusetts. The area is largely undeveloped, wooded and swampy. Several elongated hills are located within the drainage area. Several residences occur within the drainage area although most of the residences are situated along the shores of the reservoir.
- b. Discharge. Normal discharge is over an ungated spillway. The spillway, which is about 50 feet long, consists of a short ogee section with a stone cascade. The crest of the spillway is at El 842.0. The excavated channel at the spillway is at El 831.0. Flow is directed parallel to the toe of the dam where it intersects the natural stream bed downstream from the low-level outlet. Flow passes under a gravel road and continues to Bartons Brook, about 400 feet downstream. Flow discharges to Greenville and Rochdale Ponds further downstream.

The flow discharges into the French River at Rochdale, about 2-1/2 miles downstream from the dam.

The spillway and 60-inch outlet can discharge an estimated 1,730 cfs with the water surface at El 845.6, which is assumed to be the low point on the crest of the dam. Under the full PMF, the dam will discharge 2,970 cfs at El 846.4 and the crest would be overtopped by about 0.8 feet. The spillway alone can discharge 1,370 cfs while the 60-inch outlet will discharge 360 cfs.

The maximum flood level at the dam is unknown. Past inspection records infer that the dam was not overtopped during the 1938 flood. There is no evidence that the dam was overtopped in the 1955 flood, although there was some reported damage to the dam.

- c. Elevation (feet above Mean Sea Level (MSL)). A benchmark at El 842.0 was established at the spillway crest. This elevation was based upon

STILES RESERVOIR DAM

the United States Geological Survey (USGS)
topographic map (1969) water surface elevation
for Stiles Reservoir.

- (1) Top dam: 845.6 to 846.8
- (2) Test flood pool: 846.4
- (3) Design surcharge: Unknown
- (4) Full flood control pool: Not Applicable
(N/A)
- (5) Recreation pool: 842.0
- (6) Spillway crest (ungated): 842.0
- (7) Upstream portal invert diversion tunnel:
N/A
- (8) Stream bed at centerline of dam: 817.1
- (9) Maximum tailwater: N/A

d. Reservoir

- (1) Length of maximum pool: 9,700 feet
- (2) Length of recreation pool: 9,700 feet
- (3) Length of flood control pool: N/A

e. Storage (acre-feet)

- (1) Test flood surcharge: 1,450 (Net) at
El 846.4
- (2) Top of dam: 3,100
- (3) Flood control pool: N/A
- (4) Recreation pool: 2,700 (Approximate)
- (5) Spillway crest: 2,700

STILES RESERVOIR DAM

f. Reservoir Surface (acres)

- *(1) Top dam: 325
- *(2) Test flood pool: 325
- (3) Flood-control pool: N/A
- (4) Recreation pool: 325
- (5) Spillway crest: 325

g. Dam

- (1) Type: earthfill
- (2) Length: 500 feet
- (3) Height: 29 feet
- (4) Top width: 15 feet
- (5) Side slopes: upstream - 1-1/4:1
downstream - 2:1
- (6) Zoning: Unknown
- (7) Impervious core: Unknown
- (8) Cutoff: Unknown
- (9) Grout curtain: Unknown

1. Spillway

- (1) Type: ogee
- (2) Length of weir: 50 feet
- (3) Crest elevation: 842.0 MSL (assumed benchmark)
- (4) Gates: None

*Based on the assumption that the surface area will not increase significantly with changes in reservoir elevation from 842.0 to 845.6.

STILES RESERVOIR DAM

- (5) Upstream channel: bottom is gravel fill
- (6) Downstream channel: flat, stone-lined boulder covered
- (7) General: 11 foot wide by 4-1/2 foot high concrete box culvert and two 5-foot concrete pipe culverts under gravel road, 200 feet downstream

j. Regulating Outlets. There are two regulating outlets at the dam. The first, a 60-inch diameter pipe conduit controlled by a steel sluice gate, was installed after the flood of 1955. The control gate operating mechanism (hand crank) is located in a locked structure at the south abutment of the spillway. The second (low-level) outlet, which is assumed to be inoperable since it has not been operated for many years, is located about 160 feet from the north abutment of the dam within the embankment. The outlet consists of a 24-inch diameter cast-iron pipe with a corrugated metal extension. The outlet is controlled by a valve situated in a well on the upstream slope. The operating mechanism is housed in a locked structure.

SECTION 2

ENGINEERING DATA

- 2.1 General. There are three drawings dated June, 1957, showing Plan of Repairs to Stiles Reservoir Dam, and one drawing dated April, 1958, titled Revised Plan of Repairs to Stiles Reservoir Dam. Copies of the drawings, which are included in Appendix B of this report, were obtained from the Worcester County Engineering Department. The drawings show proposed repairs to the embankment and spillway and addition of toe drains and flood gates.

According to the Owner, the reservoir and dam have been part of a study for possible hydroelectric power generation. As part of this study, hydraulic computations have been completed.

No other plans, specifications, or computations are available from the Owner, State or County relative to the design, construction or repair of this dam.

We acknowledge the assistance and cooperation of personnel of the Massachusetts Department of Public Works: Messrs. Willis Regan and Raymond Rochford, and of the Massachusetts Department of Environmental Quality Engineering, Division of Waterways: Messrs. John J. Hannon and Joseph Iagallo.

Also, we acknowledge the cooperation and assistance of personnel from the Worcester County Engineer's Office: Messrs. John O'Toole and Joseph Brasauskas and Mr. Raymond Shea, who answered questions for the owner.

- 2.2 Constructon Records. The only construction records are the Plans referred to in Section 2.1 and included in Appendix B. There are no as-built drawings for the dam, spillway or outlet structures.
- 2.3 Operating Records. No operating records are available, and there is no daily record kept of the elevation of the pool or rainfall at the dam site.

STILES RESERVOIR DAM

2.4 Evaluation

- a. Availability. There is limited engineering data available.
- b. Adequacy. The lack of detailed hydraulic, structural, and construction data did not allow for a definitive review. Therefore, the evaluation of the adequacy of this dam is based on review of available drawings, visual inspection, past performance history, and engineering judgment.
- c. Validity. Comparison of the available drawings with the field survey conducted during the Phase I inspection indicates that the available information is valid.

SECTION 3
VISUAL INSPECTION

3.1 Findings

- a. General. The Phase I Inspection of the dam at Stiles Reservoir was performed on November 16, 1978. A copy of the inspection checklist is included in Appendix A. Previous inspections of this dam and of the original dam at this site have been made by others since 1923. A partial listing of these inspections is in Appendix B. The latest inspection by others was made in 1977 by personnel from the Massachusetts Department of Public Works. A copy of their report is included in Appendix B.
- b. Dam. Stiles Reservoir Dam is an earthfill dam that has a history of leakage since at least 1923. Past inspection reports have documented various leaks at the dam. At the time of the Phase I inspection, there were three areas of leakage noted. A serious and apparently perennial leak occurs in the vicinity of the low-level outlet. Water, estimated flowing at 50 to 70 gpm is discharging immediately to the south of the 24-inch low-level outlet from beneath the dam. The water appears to be clear, however. Several feet downstream of the outlet and within the discharge channel, a small, approximately 6-inch diameter, upward seepage zone was noted. Water flowing to the surface did not appear to be dislodging soil particles. A second leak was noted within the south spillway abutment near the toe of the dam. A small cavity was noted between the training wall and earth abutment. A third small leak was noted flowing beneath the 60-inch concrete conduit.

Water was not observed to be flowing out of the 24-inch outlet. Apparently, the gate valve is fully closed. The 12-inch diameter corrugated metal toe drain appeared to be operable as a 1 to 2 gpm flow was estimated coming from the drain north of the low-level outlet and a trickle coming from the drain south of the outlet.

STILES RESERVOIR DAM

Riprap on the upstream slope appeared to be in fair condition. Some slight depression along the crest at the downstream side was noted as well as some small holes less than 12 inches in diameter and 6 inches deep. There were trees and small brush along some areas of the downstream slope. The toe of the dam had many trees and saplings growing. A large area of standing water was noted in the downstream area to the north of the outlet discharge channel (see Figure B-1).

- c. Appurtenant Structures. The 50-foot long spillway and stepped cascade appeared to be in fair condition except for the leak previously noted. Small trees were growing within the discharge channels. In addition, the channels contained some small boulders.

The gate-operating mechanism to the low level, although apparently not operable, appeared in fair condition. The housing for the mechanism was also in fair condition. The mortared stone masonry wall built around the valve and stem was leaking through joints where mortar was missing.

The 60-inch gate and conduit appeared in fair condition. The gate was clogged with a piece of debris so the gate could not be fully closed and was leaking. The gate however is in operable condition and the mechanism appeared well maintained.

The outlet conduit, consisting of sections of 60-inch diameter concrete pipe, was in fair condition. Signs of movement at the joints of the pipes were noticed and the joints were stained. Water was observed seeping into the conduit at the joints within the lower third of the pipe.

A stone masonry wall at the toe of the dam deflects the spillway discharge to the stream bed and also protects the downstream toe area from erosion.

- d. Reservoir Area. The area around Stiles Reservoir is sparsely developed except immediately

STILES RESERVOIR DAM

adjacent to the Reservoir where there are numerous residences. The drainage area consists mainly of swamps and hills.

- e. Downstream Channel. Discharge from the spillway enters Bartons Brook which flows into Greenville Pond and then into Rochdale Pond, eventually ending in the French River about 2-1/2 miles downstream. The discharge channel immediately adjacent to the dam has trees and saplings lining the channel and within the channel. Baldwin Street crosses Bartons Brook and River Street crosses between Bartons Brook and Greenville Pond. Both roads form an obstruction to flow. The Village of Rochdale is immediately downstream of Rochdale Pond.

- 3.2 Evaluation. The above findings indicate that the dam is in poor condition, and there are several deficiencies which require attention. Although the owner stated that from time to time, the leaks which have occurred in the past are repaired by grouting, there still remain serious leaks within the dam that form a potential hazard. Recommended measures to improve these conditions are stated in Section 7.3.

STILES RESERVOIR DAM

SECTION 4

OPERATING PROCEDURES

- 4.1 Procedures. According to the Owner, the dam is inspected weekly by representatives of the Central Water District. If flooding is anticipated, or large rainfalls are expected, the gates reportedly would be opened to lower the reservoir level. The Reservoir is drawn down 3+ feet every winter in anticipation of high spring runoff.
- 4.2 Maintenance of Dam. According to the Owner, the dam is maintained periodically, usually in the Spring by cutting brush and vegetation. Also, the dam is apparently examined for hazardous conditions and such conditions are repaired. However, the severe leakage observed during the inspection has been noted for several years in prior inspection reports.
- 4.3 Maintenance of Operating Facilities. The low-level outlet (24-inch diameter) is not used and apparently not maintained. It is assumed inoperable. The gates to the 60-inch outlet are reportedly maintained and cleaned when needed. During the inspection, some debris was observed lodged in the gate causing it to leak. The operating mechanism to the gates was in good condition and was operable.
- 4.4 Description of Any Warning Systems in Effect. There is no warning system in effect at this dam.
- 4.5 Evaluation. According to the owner, there is a regular program of maintenance for the dam. Based on the results of the visual inspection it is concluded that additional maintenance is required. A systematic and complete inspection, maintenance and surveillance program should be instituted at this dam.

STILES RESERVOIR DAM

SECTION 5

HYDRAULIC/HYDROLOGIC

5.1 Evaluation of Features

- a. General. Drainage to Stiles Reservoir originates principally in wooded hills and swampy areas in the Town of Spencer to the west of the reservoir. The drainage area consists of about 2,880 acres (4.5 square miles) of sparsely populated areas. The dam at Stiles Reservoir is an earthfill dam. The spillway weir, situated at the south abutment, is about 50-foot long, short ogee-type with a crest at El 842.0. There are no provisions for flashboards on the spillway.

Overtopping will occur over the low point on the crest of the dam at El 845.6. A 24-inch diameter low-level outlet apparently not operated in past years, is located within the embankment and has an invert of El 817.1. A flood outlet consisting of a 60-inch diameter pipe and manually operated sluice gate is located at the south abutment of the spillway. The gate is operable. The invert of the outlet at the entrance is approximately El 835.8. The capacity of this outlet is 360 cfs with a water surface at El 845.6. The reservoir level could be lowered 1 foot below spillway crest by this outlet (to El 841.0) in about 14 hours.

- b. Design Data. There are no hydraulic computations available for the design of this dam. The Owner reportedly has hydraulic computations for the facilities completed by personnel from Worcester Polytechnical Institute for a proposed hydroelectric project.
- c. Experience Data. Hydraulic records are not available for this dam. Past inspection reports infer that the dam was not overtopped in 1938. The records are unclear about the 1955 flood. However, past records mention sandbags were placed on top of the dam during the 1955 flood and later the embankment was raised

STILES RESERVOIR DAM

1 foot. This indicates that the dam may have been very close to being overtopped.

- d. Visual Observations. The spillway appears in good condition except for the leak within the south abutment. The training walls have been repaired in the past and consist of concrete and mortared stone masonry. There is a concrete cap on top of the walls. Some cracks at the joints of the stone wall were noted.

The spillway which is ungated has no provisions for flashboards. The crest is a short ogee type section discharging to a stepped cascade. The approach channel to the spillway is unobstructed. The discharge channel is riprapped for a short distance below the spillway and is filled with some boulders and small brush.

A 60-inch diameter outlet was constructed after the 1955 storm. The outlet is operable, and discharges into the spillway channel located in the south abutment of the dam.

A 24-inch low level outlet within the dam apparently has not been operated recently. The operating mechanisms for each outlet are housed in locked structures.

- e. Test Flood Analysis. The Probable Maximum Flood (PMF) rate was determined to be 950 cfs per square mile. This calculation is based on the average slope of the drainage area of 1.5 percent, the pond-plus-swamp area to drainage area ratio of 21 percent, and the U.S. Army Corps of Engineers' guide curves for Maximum Probable Flood Peak Flow Rates (dated December 1977). Applying the full PMF to the 4.5 square miles of drainage area results in a calculated peak flood flow of 4,300 cfs as the inflow test flood. By adjusting the inflow test flood for surcharge storage, the maximum discharge rate was established as 2,970 cfs (600 cfs per square mile), with a water surface at El 846.4. This assumes the low-level outlet is inoperable.

Hydraulic analyses indicate that the spillway and flood gate could discharge 1,730 cfs when

STILES RESERVOIR DAM

the water surface is at El 845.6 which is the low point on the crest of the dam. The spillway alone could discharge 1,370 cfs with water at the same elevation. The maximum discharge rate established for the full PMF is 2,970 cfs. The crest of the dam will be overtopped by about 0.8 feet under these conditions.

- f. Dam Failure Analysis. Assuming a failure of the dam with the water surface at El 845.6, which is the low area on the crest of the dam, the peak discharge flood flow would be about 34,800 cfs. At El 845.6, the spillway and 60-inch outlet would be discharging 1,730 cfs which would produce a 5 foot depth of flow. Failure of the dam would produce a total depth of 18.5 feet in the channel. It is probable that the resulting flood would have a severe impact on many residences along River Street. Also, the Village of Rochdale could be impacted by flooding.

STILES RESERVOIR DAM

SECTION 6

STRUCTURAL STABILITY

6.1 Evaluation of Structural Stability

- a. Visual Observations. The evaluation of the structural stability of Stiles Reservoir Dam is based on a review of available drawings and the visual inspection conducted on November 16, 1978. A detailed discussion of the visual inspection appears in Section 3, Visual Inspection. Based on this inspection, the dam is judged to be in poor condition.

Those factors which are considered of major importance to the stability of the dam include the three areas of leakage observed during the inspection. Severe leakage through the dam at the area of the low-level outlet appears serious. Also of concern is the leakage at the foot of the south training wall to the spillway. The leakage beneath the 60-inch diameter outlet also presents a hazard. The upward seepage condition at the downstream toe within the low-level outlet discharge channel could present a hazard to the stability of the dam.

- b. Design and Construction Data. Discussions with the Owner, County and State personnel indicate that there are no available plans, specifications or computations on the design, or construction of the original dam.

Drawings of repairs made to the spillway and embankment are included in Appendix B.

Information does not appear to exist on the type, shear strength, and permeability of the soil and/or rock materials of the embankment.

- c. Operating Records. There is no instrumentation of any type in Stiles Reservoir Dam, and no instrumentation was ever reported installed in this dam. The performance of this dam under prior loading can only be inferred from physical evidence at the site.

STILES RESERVOIR DAM

- d. Post-Construction Changes. There are no as-built drawings available for Stiles Reservoir Dam. Based on visual evidence, and field measurements, the dam appears to have been repaired essentially as shown on the 1957 and 1958 drawings.
- e. Seismic Stability. The dam is located in Seismic Zone No. 2 and in accordance with Phase I "Recommended Guidelines" does not warrant seismic analyses.

SECTION 7

ASSESSMENT, RECOMMENDATIONS, AND REMEDIAL MEASURES

7.1 Dam Assessment

- a. Condition. Based upon a review of available drawings, the visual inspection of the site and limited operational or maintenance information, there are deficiencies which must be corrected to assure the continued performance of this dam. Generally, the dam is considered to be in poor condition. Several signs of distress were observed at the site: severe leakage beneath the embankment at the low-level outlet area; upward seepage of water near the downstream toe of the dam at the low-level outlet area; seepage at the south spillway training wall; seepage beneath the 60-inch diameter outlet. Possible seepage and standing water downstream of the north abutment should also be investigated. In addition, other maintenance functions such as control of vegetation on the dam and repairing low-level outlet should be undertaken.

Hydraulic analyses indicate that the spillway and 60-inch outlet can discharge a flow of 1,730 cfs with the water surface at El 845.6 which is the low point on the crest of the dam. An outflow test flood of 2,970 cfs (full probable maximum flood) will overtop the dam by 0.8 feet. The spillway alone will only discharge 1,370 cfs with the water surface at El 845.6.

- b. Adequacy. The lack of detailed design and construction data did not allow for a definitive review. Therefore, the evaluation of the adequacy of this dam is based primarily on review of available drawings, visual inspection, past performance and engineering judgment.
- c. Urgency. The recommendations and remedial measures outlined below should be implemented by the Owner within one year after receipt of this Phase I Inspection Report.

STILES RESERVOIR DAM

- d. Need for Additional Investigation. Additional investigations to further assess the adequacy of the dam are outlined below in Section 7.2 Recommendations.

7.2 Recommendations. In view of the concerns over the continued performance of the dam, it is recommended that the Owner employ a qualified consultant to investigate and evaluate the leakage and upward flow of water at the dam within the downstream toe area and spillway. In the interim, the 60-inch outlet should be opened to reduce the pressure head within the embankment and foundation. The consultant should also perform a detailed hydraulic/hydrologic analysis to evaluate the spillway capacity.

Recommendations on repairs and maintenance procedures are outlined below under Section 7.3, Remedial Measures.

7.3 Remedial Measures

- a. Operating and Maintenance Procedures. The dam and appurtenant structures are not adequately maintained. It is recommended that the Owner accomplish the following:
- (1) Immediately open the 60-inch outlet and drain the pond to the invert elevation (El 835.2).
 - (2) Repair the leaks indicated in Section 3, Visual Inspection, based on recommendations by a qualified consultant.
 - (3) Clear the trees and brush from the dam and within 50 feet of the downstream toe. The discharge channel should also be kept clear of trees and brush.
 - (4) Repair the low-level outlet.
 - (5) Monitor the joints of the 60-inch diameter outlet for evidence of further movement and repair.

STILES RESERVOIR DAM

- (6) implement a systematic program of maintenance inspections. As a minimum, the inspection program should consist of a monthly inspection of the dam and appurtenances, supplemented by additional inspections during and after severe storms. All repairs and maintenance should be undertaken in accordance with all applicable State regulations.
 - (7) periodic technical inspections of this dam should be continued on an annual basis
 - (8) institute a definite plan for surveillance and a warning system during periods of unusually heavy rains and/or runoff.
- 7.4 Alternatives. An alternative to implementing the recommendations listed above and the maintenance procedures itemized would be to breach the dam and drain the pond. However, this may be an undesirable alternative because of water required at Rochdale Mill as well as for the aesthetic value of the area and property adjacent to the Reservoir.

STILES RESERVOIR DAM

APPENDIX A
PERIODIC INSPECTION CHECKLIST

STILES RESERVOIR DAM

PARTY ORGANIZATION

DATE Nov. 16, 1978

TIME 2:30 p.m.

WEATHER Clear & cool

W.S. ELEV. 841.4 U.S. DN.S.

Assumed benchmark El. 842

Top of spillway crest

6.

7.

8.

9.

10.

INSPECTED BY

REMARKS

R.Weber/E. Greco

R.Weber/L. Branagan

3.

4.

5.

6.

7.

8.

9.

10.

PERIODIC INSPECTION CHECK LIST

PROJECT STILES RESERVOIR DAM DATE Nov. 16, 1978
 PROJECT FEATURE Dam NAME R. Weber
 DISCIPLINE Geotechnical NAME _____

AREA EVALUATED	CONDITIONS
<u>DAM EMBANKMENT</u>	
Crest Elevation	Varies from 845.6 to 846.8
Current Pool Elevation	841.4
Maximum Impoundment to Date	Unknown
Surface Cracks	None visible
Pavement Condition	Grassed slopes-maintained on crest
Movement or Settlement of Crest	None along crest, top of slope periodic surface depressions
Lateral Movement	None visible
Vertical Alignment	Fairly level except for depressions at top of slope
Horizontal Alignment	Straight from abutment to abutment
Condition at Abutment and at Concrete Structures	Good
Indications of Movement of Structural Items on Slopes	None visible-small brush and sapplings on slope indicate no movement
Trespassing on Slopes	Footpaths
Sloughing or Erosion of Slopes or Abutments	Slight sloughing visible near top of slope in some areas
Rock Slope Protection - Riprap Failures	Riprap on upstream slope vegetation and small brush in riprap
Unusual Movement or Cracking at or near Toes	None visible
Unusual Embankment or Downstream Seepage	Leak in downstream toe within area of 15" outlet 50-70 GPM (estimated)
Piping or Boils	Upward flow of water in seepage area
Foundation Drainage Features	Unknown
Toe Drains	Partial 12-inch diameter
Instrumentation System	None

PERIODIC INSPECTION CHECK LIST

PROJECT STILES RESERVOIR DAM DATE Nov. 16, 1978

PROJECT FEATURE Control Tower at Spillway NAME R. Weber

DISCIPLINE Geotechnical NAME _____

AREA EVALUATED	CONDITION
<u>OUTLET WORKS - CONTROL TOWER</u>	
a. Concrete and Structural	
General Condition	Good
Condition of Joints	Good
Spalling	None visible
Visible Reinforcing	None visible
Rusting or Staining of Concrete	None visible
Any Seepage or Efflorescence	None visible
Joint Alignment	-
Unusual Seepage or Leaks in Gate	Debris caught in gate causes leakage
Cracks	None visible
Rusting or Corrosion of Steel	None visible
b. Mechanical and Electrical	
Air Vents	-
Float Wells	-
Crane Hoist	-
Elevator	-
Hydraulic System	-
Service Gates	Good
Emergency Gates	-
Lightning Protection System	-
Emergency Power System	-
Wiring and Lighting System in Gate Chamber	-

PERIODIC INSPECTION CHECK LIST

PROJECT STILES RESERVOIR DAM

DATE Nov. 16, 1978

PROJECT FEATURE Control Tower
at Embankment

NAME R. Weber

DISCIPLINE Geotechnical

NAME _____

AREA EVALUATED	CONDITION
<u>OUTLET WORKS - CONTROL TOWER</u>	
a. Concrete and Structural	Mortared stone masonry
General Condition	Fair
Condition of Joints	-
Spalling	Some mortar missing
Visible Reinforcing	-
Rusting or Staining of Concrete	-
Any Seepage or Efflorescence	Well around gate valve leaks
Joint Alignment	-
Unusual Seepage or Leaks in Gate	
Cracks	Minor at joints
Rusting or Corrosion of Steel	-
b. Mechanical and Electrical	
Air Vents	-
Float Wells	-
Crane Hoist	-
Elevator	-
Hydraulic System	-
Service Gates	Assumed inoperable
Emergency Gates	-
Lightning Protection System	-
Emergency Power System	-
Wiring and Lighting System in Gate Chamber	-

PERIODIC INSPECTION CHECK LIST

PROJECT STILES RESERVOIR DAM

DATE Nov. 16, 1978

PROJECT FEATURE Outlet Pipe

NAME R. Weber

DISCIPLINE Geotechnical

NAME _____

AREA EVALUATED	CONDITION
<u>OUTLET WORKS - OUTLET STRUCTURE AND OUTLET CHANNEL</u>	
General Condition of Concrete	-
Rust or Staining	-
Spalling	-
Erosion or Cavitation	-
Visible Reinforcing	-
Any Seepage or Efflorescence	
Condition at Joints	-
Drain Holes	-
Channel	
Loose Rock or Trees Over- hanging Channel	Small sapplings and brush within channel
Condition of Discharge Channel	Fair - bounded by masonry wall and earth slope

*for spillway discharge channel see Spillway check sheet.

PERIODIC INSPECTION CHECK LIST

PROJECT STILES RESERVOIR DAM

DATE Nov. 16, 1978

PROJECT FEATURE Spillway

NAME R. Weber/L. Branagan

DISCIPLINE Geotechnical

NAME _____

AREA EVALUATED	CONDITION
<u>OUTLET WORKS - TRANSITION AND CONDUIT</u>	
General Condition of Concrete	Fair to good
Rust or Staining on Concrete	Staining at joints within conduit
Spalling	None visible-mortar displaced from joints
Erosion or Cavitation	None visible
Cracking	None visible
Alignment of Monoliths	-
Alignment of Joints	Some displacement of pipes
Numbering of Monoliths	-

Leak into joints of conduit at bottom ^{1/}3rd of most joints.

PERIODIC INSPECTION CHECK LIST

PROJECT STILES RESERVOIR DAM

DATE Nov. 16, 1978

PROJECT FEATURE Spillway

NAME R. Weber

DISCIPLINE Geotech/Hyd.

NAME L. Branagan

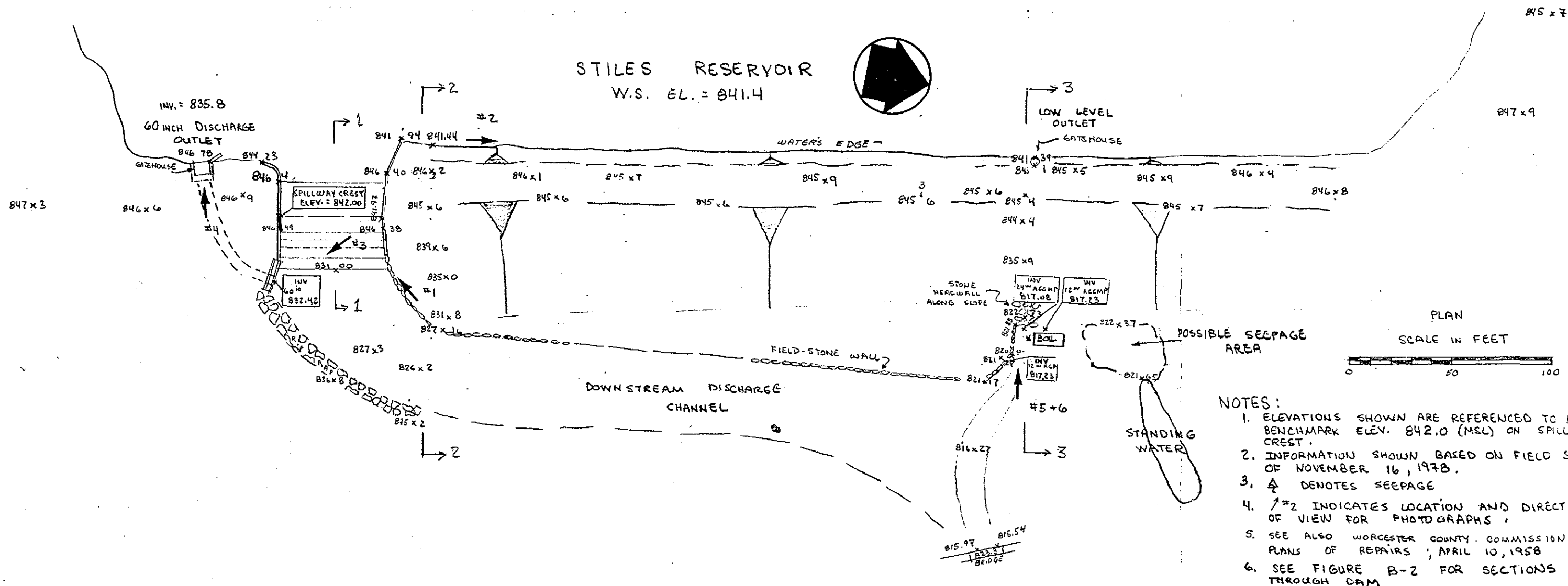
AREA EVALUATED	CONDITION
<u>OUTLET WORKS - SPILLWAY WEIR, APPROACH AND DISCHARGE CHANNELS</u>	
a. Approach Channel	
General Condition	Fair-erosion on right wall some on left wall
Loose Rock Overhanging Channel	None
Trees Overhanging Channel	None
Floor of Approach Channel	Concrete and cobble
b. Weir and Training Walls	
General Condition of Concrete	Stone masonry, slight cracks, some stones missing
Rust or Staining	None
Spalling	Some mortar at joints missing
Any Visible Reinforcing	None
Any Seepage or Efflorescence	Rt. side between sidewall and abutment at toe
Drain Holes	None
c. Discharge Channel	
General Condition	Fair
Loose Rock Overhanging Channel	None
Trees Overhanging Channel	Some small trees
Floor of Channel	Boulders, debris, vegetation
Other Obstructions	None

APPENDIX B

PLANS OF DAM AND PREVIOUS
INSPECTION REPORTS

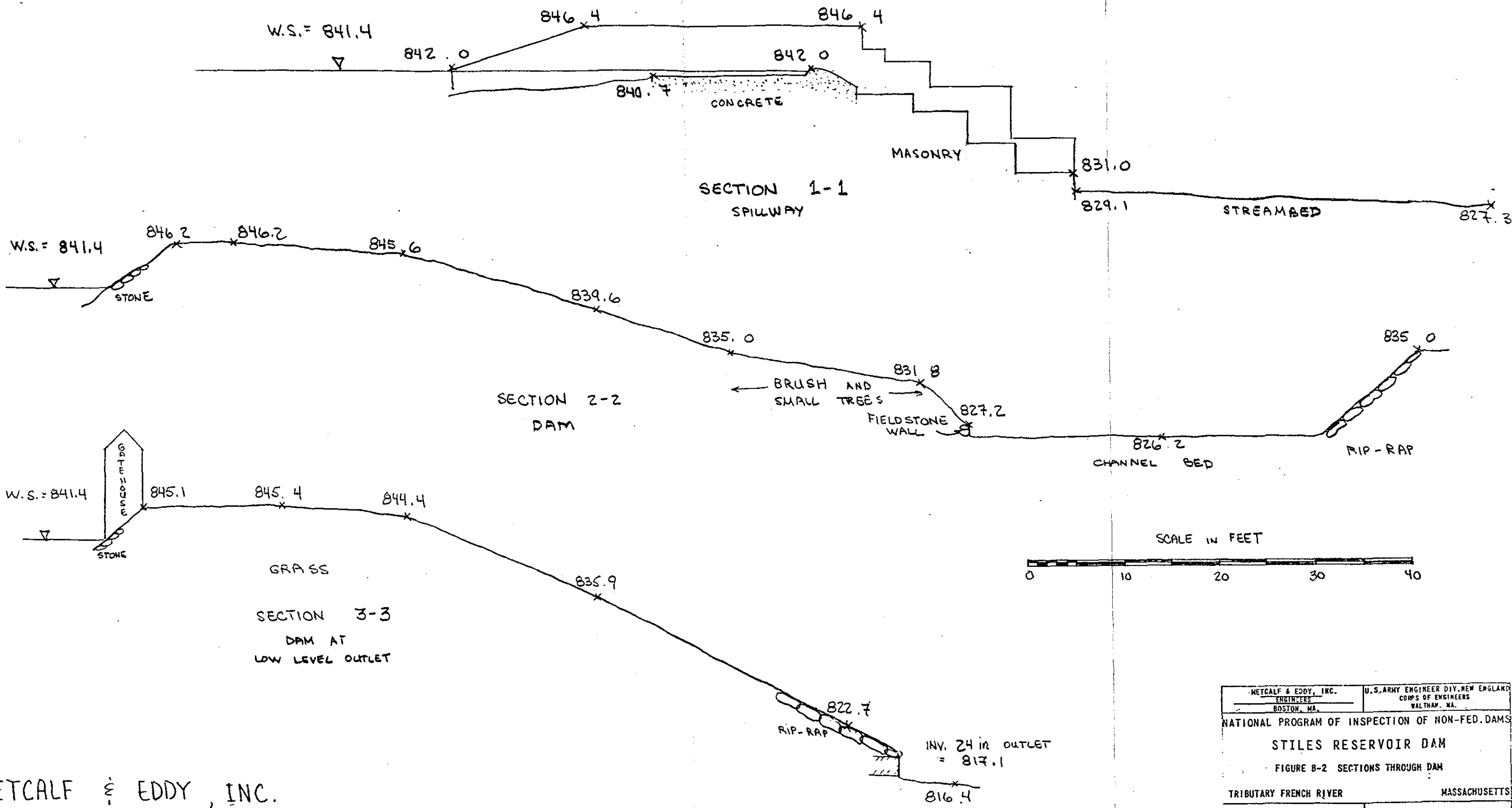
	<u>Page</u>
Figure B-1 Plan of Dam	B-1
Figure B-2 Sections through Dam	B-2
Figure B-3 Plan of Repairs, April 10, 1958	B-3
Figure B-4 Plan of Repairs, June 11, 1957	B-4
Figure B-5 Plan of Repairs, PLAN AND PROFILE, June 11, 1957	B-5
Figure B-6 Plan of Repairs, PLAN AND PROFILE, June 11, 1957	B-6
Previous Inspections (Partial Listing)	B-7
County Commissioners Order for Alterations and Repairs	B-8
Letter Report to Massachusetts Department of Public Works	B-12
Letter Report to Worcester County Commissioners	B-13
Inspection Report, July 9, 1976	B-15
Letter Report to Charlton Woolen Mills	B-19
Letter Report to Town Counsel, June 15, 1977	B-20
Inspection Report, June 17, 1977	B-22
Inspection Report, June 20, 1977	B-25
Letter Report to Central New England Realty Trust, July 18, 1977	B-28

STILES RESERVOIR DAM



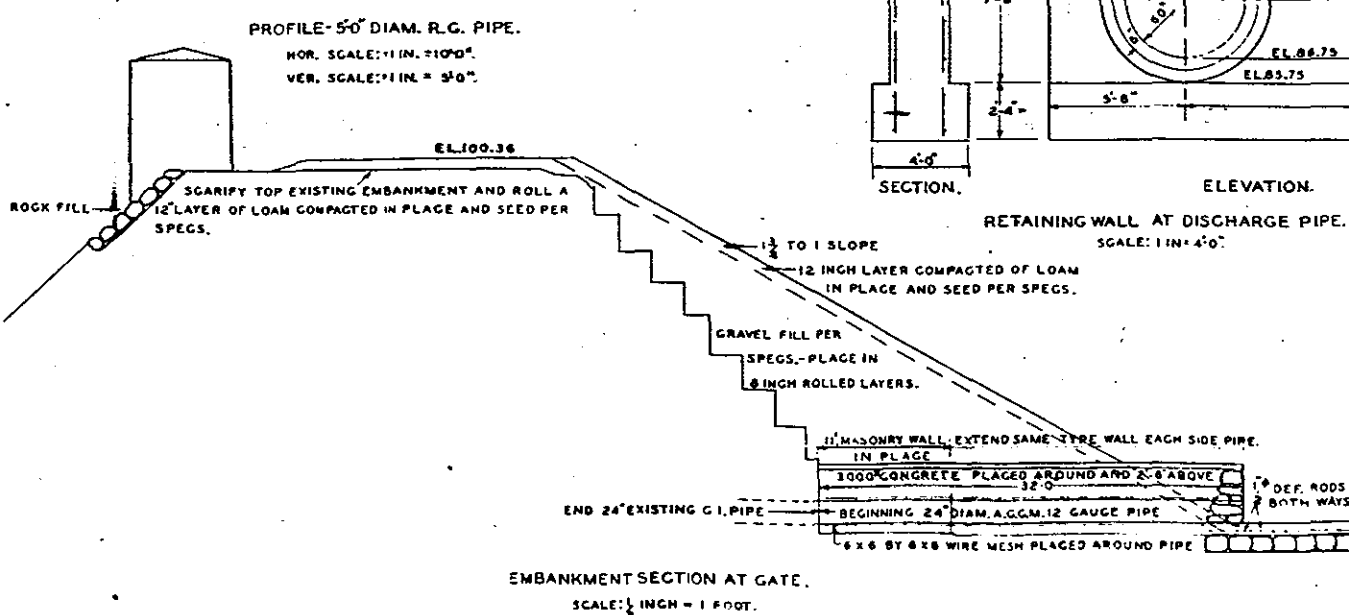
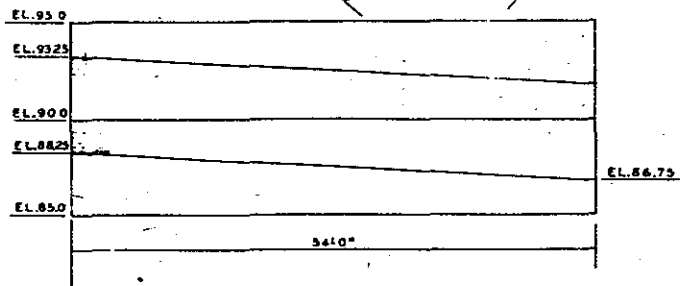
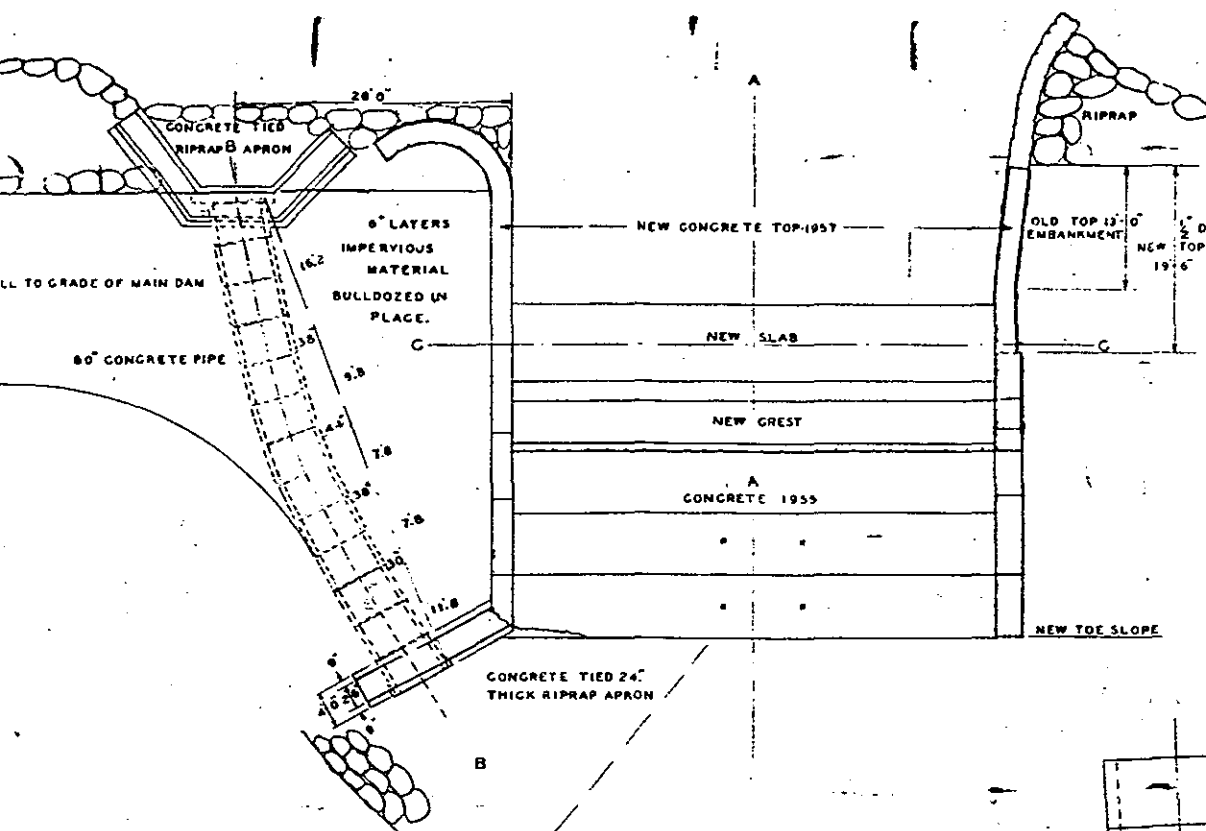
METCALF & EDDY, INC.

METCALF & EDDY, INC. ENGINEERS BOSTON, MA.	U.S. ARMY ENGINEER DIV. NEW ENGLAND CORPS OF ENGINEERS WALTHAM, MA.
NATIONAL PROGRAM OF INSPECTION OF NON-FED. DAMS	
STILES RESERVOIR DAM	
FIGURE B-1 PLAN OF DAM	
TRIBUTARY FRENCH RIVER	MASSACHUSETTS
SCALE: 1" = 50'	DATE: JANUARY, 1979

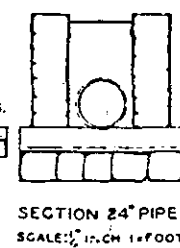
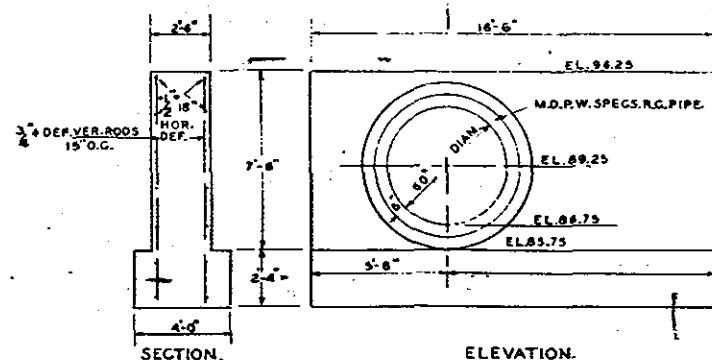


METCALF & EDDY, INC.

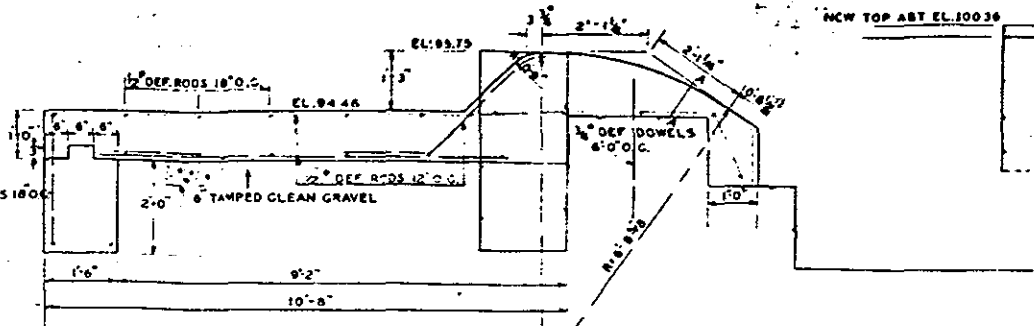
METCALF & EDDY, INC. ENGINEERS BOSTON, MA.	U.S. ARMY ENGINEER DIV. NEW ENGLAND CORPS OF ENGINEERS WALTHAM, MA.
NATIONAL PROGRAM OF INSPECTION OF NON-FED. DAMS	
STILES RESERVOIR DAM	
FIGURE B-2 SECTIONS THROUGH DAM	
TRIBUTARY FRENCH RIVER	MASSACHUSETTS
SCALE: 1" = 10'	DATE: JANUARY, 1979



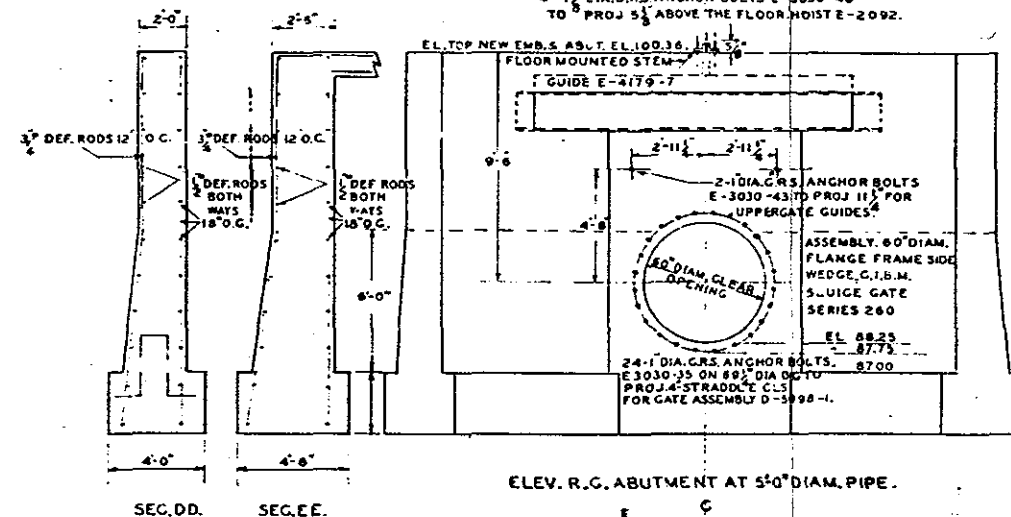
EMBANKMENT SECTION AT GATE.
SCALE: 1/2 INCH = 1 FOOT.



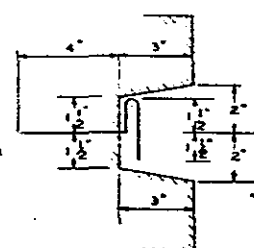
SECTION 24" PIPE
SCALE: 1/2 INCH = 1 FOOT.



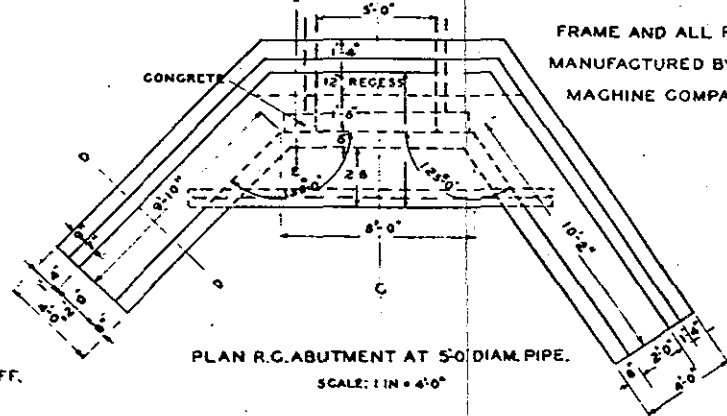
A-A SECTION NEW SPILLWAY
SCALE: 1/2 IN. = 1' 0"



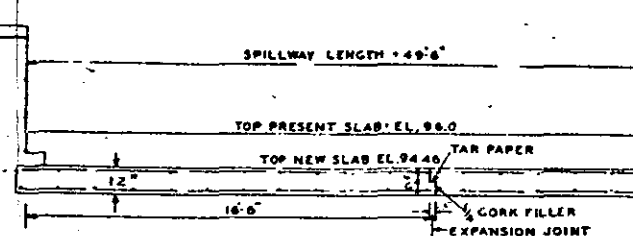
ELEV. R.C. ABUTMENT AT 50" DIAM. PIPE.



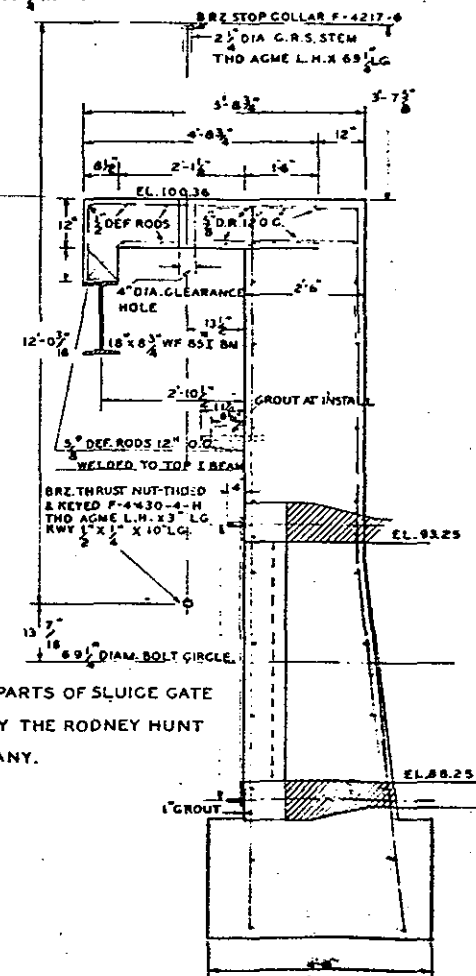
SECTION A-A.
FOLDED COPPER CUTOFF.
SCALE: 1 IN. = 4' 0"



PLAN R.C. ABUTMENT AT 50" DIAM. PIPE.
SCALE: 1 IN. = 4' 0"



C-C SECTION NEW SLAB.
SCALE: 1/2 IN. = 1' 0"



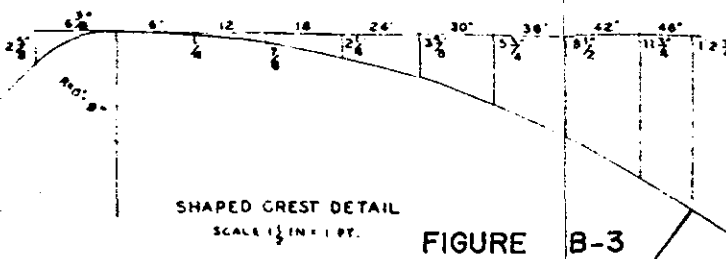
SECTION
SCALE: 1/4 IN. = 2' 0"

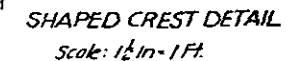
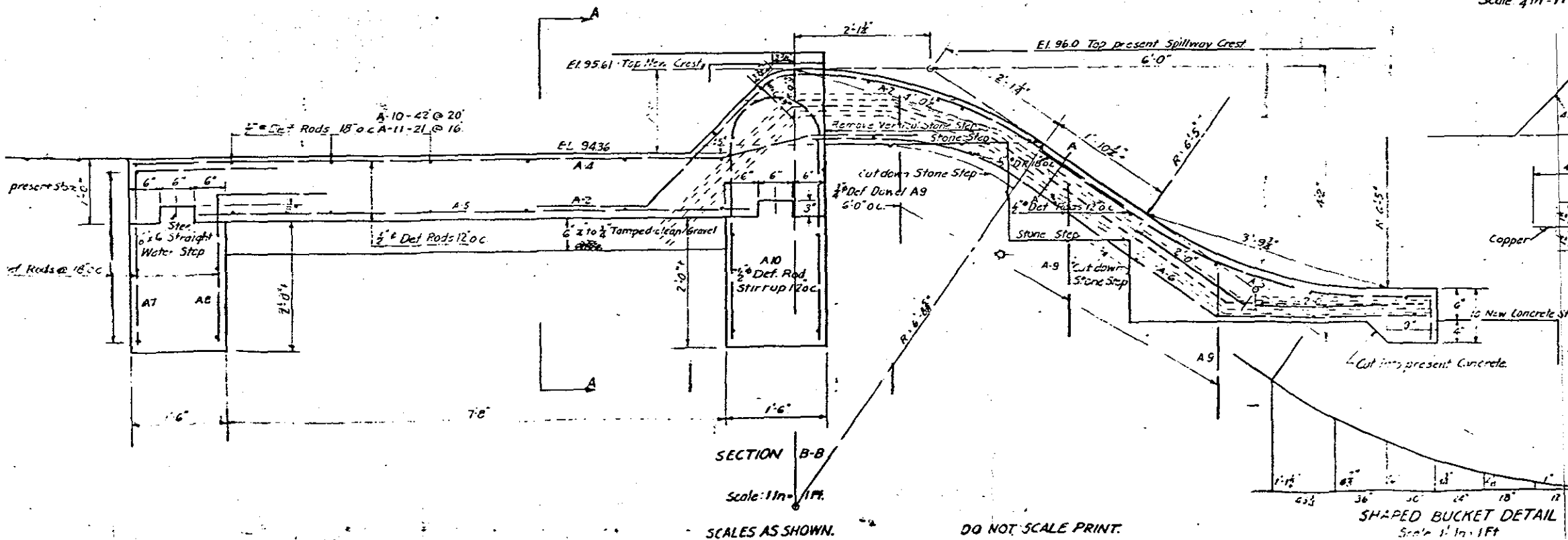
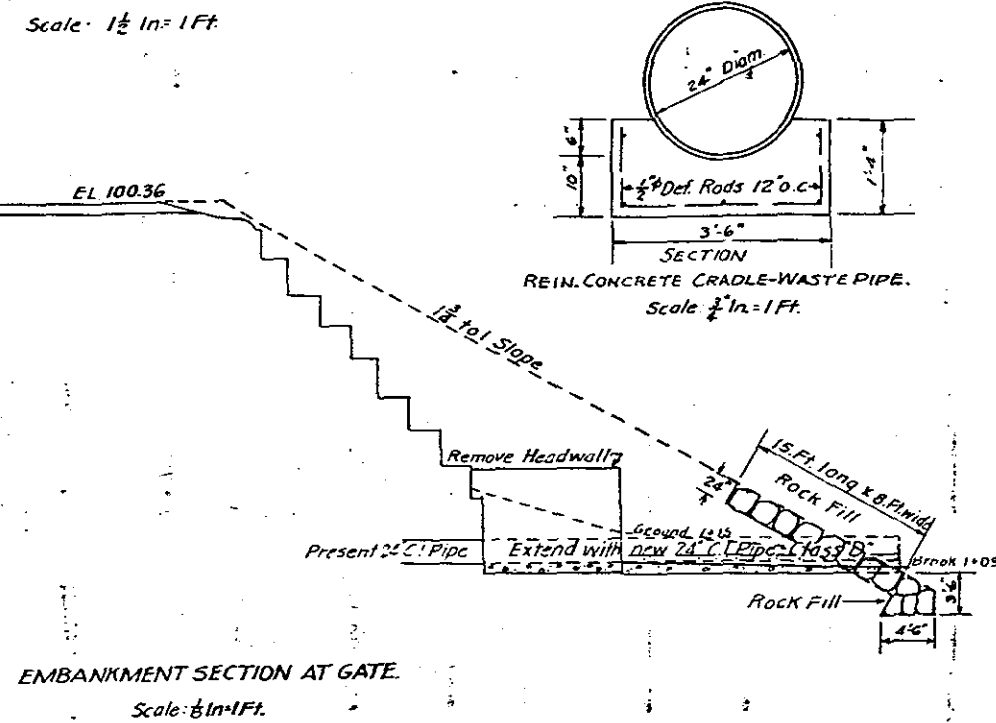
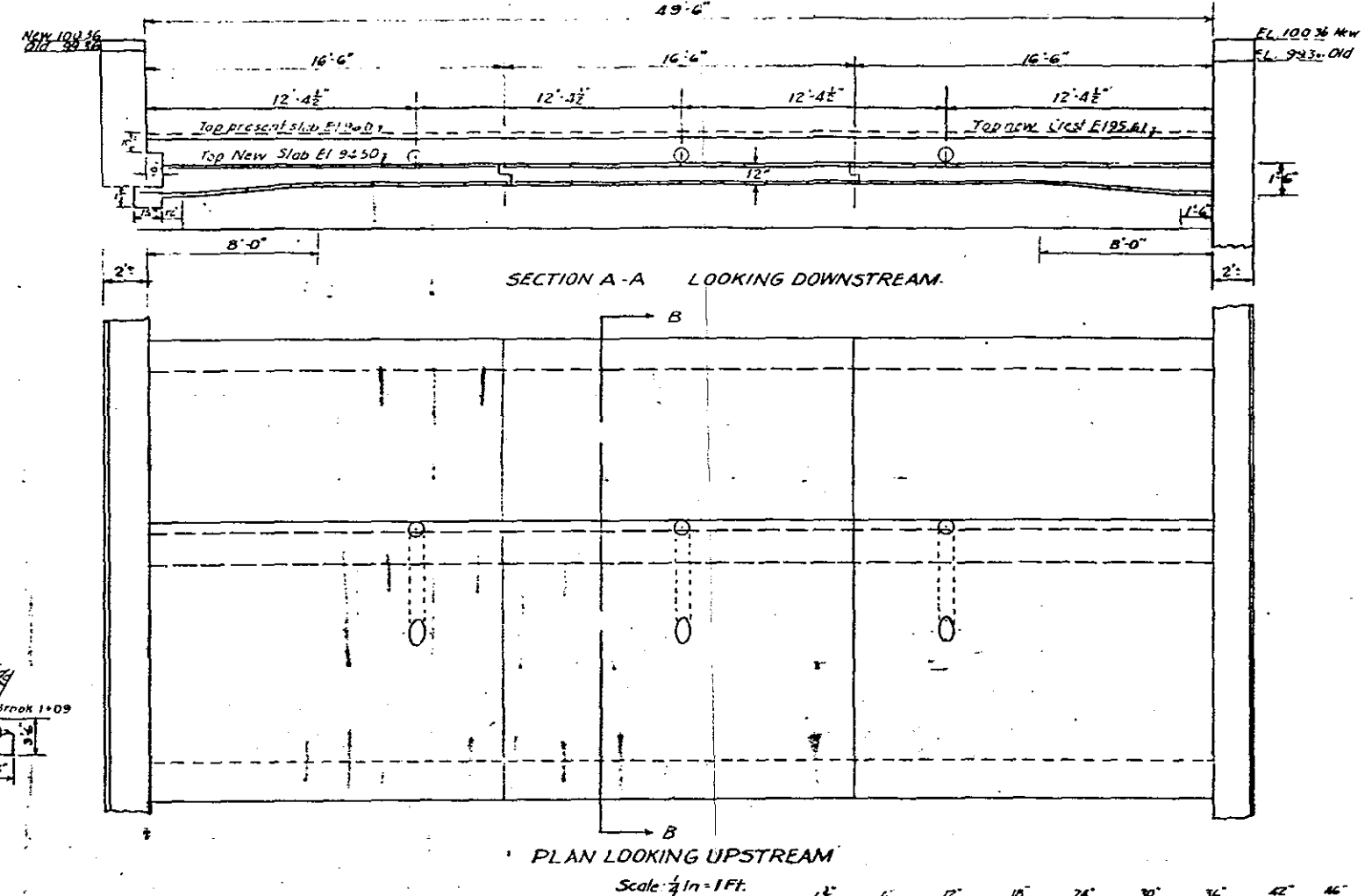
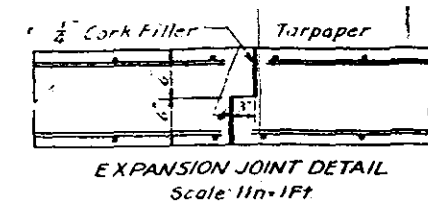
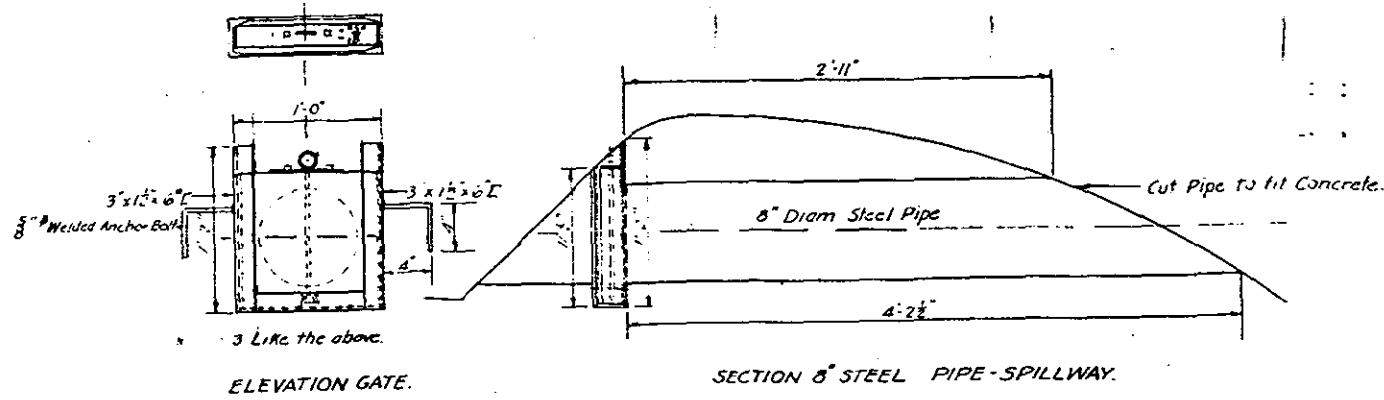
PLAN REDUCED APPROXIMATELY 50%

SPECIFICATIONS APPROVED ON PLAN DATED JUNE 11, 1957, BY THE COUNTY COMMISSIONERS. SHALL BE USED ON THIS REVISED PLAN UNLESS OTHERWISE STATED.

WORCESTER COUNTY COMMISSIONERS
WORCESTER COUNTY ENGINEERING DEPARTMENT
REVISED PLAN OF REPAIRS TO STILES RESERVOIR DAM
STILES RESERVOIR
LEICESTER, MASS.
FOR STILES RESERVOIR COMPANY
AS FILED AND APPROVED BY THE
COUNTY COMMISSIONERS

APPROVED: April 10, 1958
Edward C. Rose
CHAIRMAN
SUBMITTED: April 10, 1958
George J. Ward
ENGINEER
COMMISSIONER
ELMER L. THAM, OXFORD
DAM NO. 25-07





PLAN REDUCED APPROXIMATELY 50 %

WORCESTER COUNTY COMMISSIONERS
 WORCESTER COUNTY ENGINEERING DEPARTMENT
 PLAN OF REPAIRS TO STILES RESERVOIR DAM
 STILES RESERVOIR
 LEICESTER, MASS.
 FOR STILES RESERVOIR CORPORATION
 AS FILED AND APPROVED BY THE
 COUNTY COMMISSIONERS

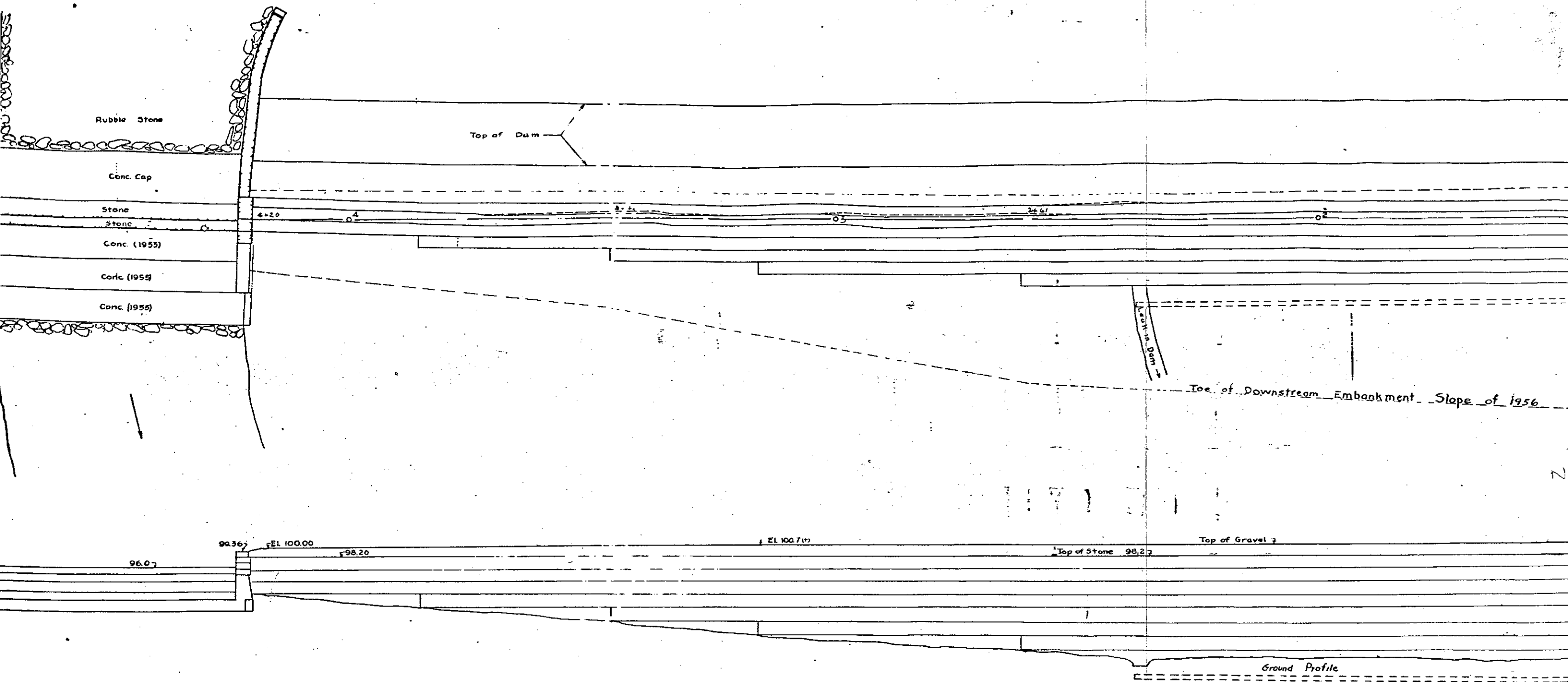
APPROVED JUNE 11 1957

Joseph A. DiSandro
 CHAIRMAN
 COMMISSIONER

SUBMITTED JUNE 11 1957
William O. Ward
 COUNTY ENGINEER
 ENGINEER
 H. WHITE, ENG. WORCES.
 DAM NO. 25-07

DO NOT SCALE PRINT.

FIGURE B-4



PLAN REDUCED APPROXIMATELY 50 %

WORCESTER COUNTY COMMISSIONERS
 WORCESTER COUNTY ENGINEERING DEPARTMENT
 PLAN OF
 STILES RESERVOIR DAM
 LEICESTER, MASS.
 FOR STILES RESERVOIR COMPANY
 AS FILED AND APPROVED BY THE
 COUNTY COMMISSIONERS

SCALES AS NOTED

TRACED BY: J. O'TOOLE
 TRACING CHECKED BY: W.O.

DAM NO. 25-0

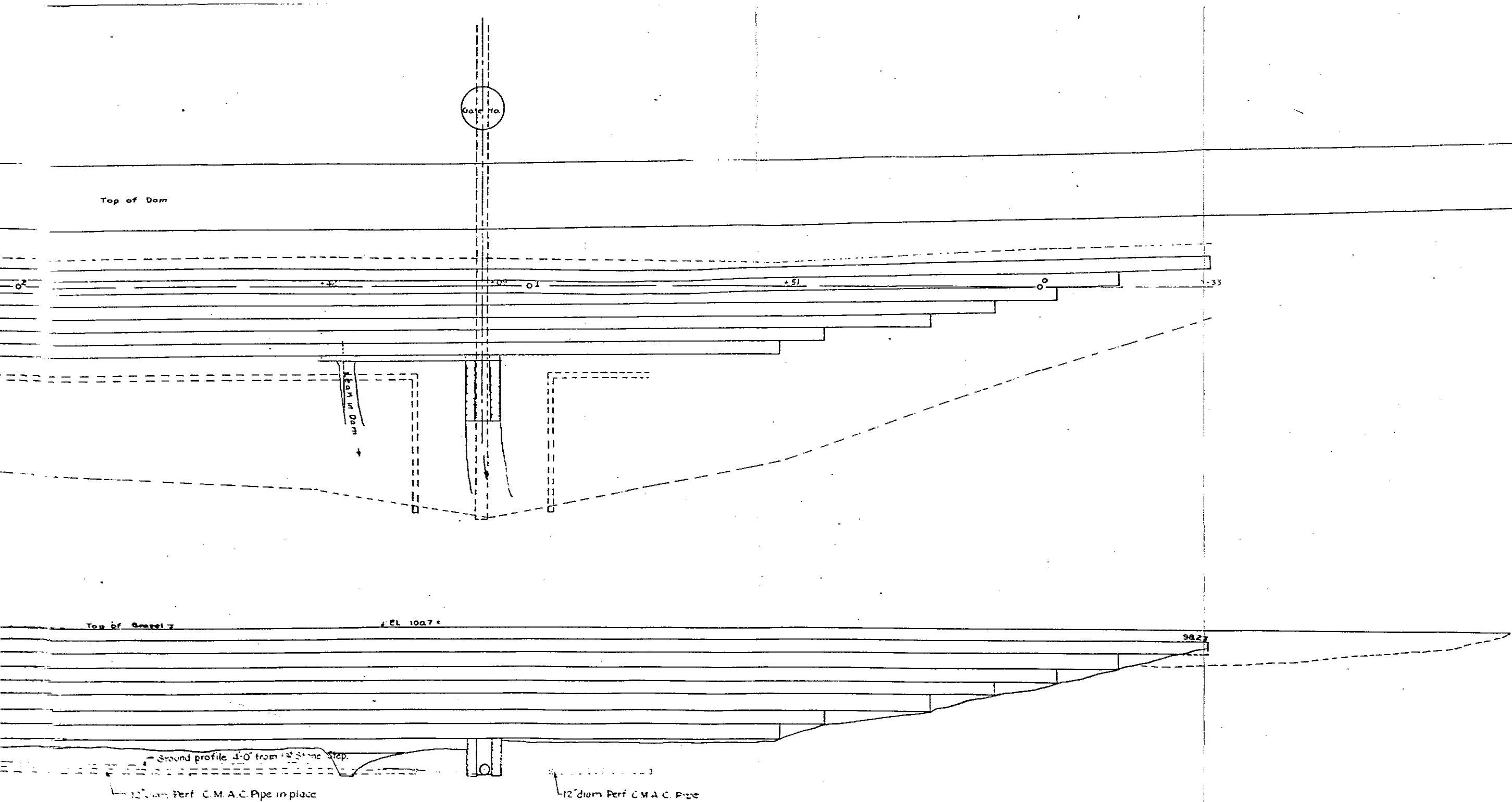
SURVEYED: FEB. 1956

SCALES

1 Inch = 10 Feet Horizontal

1 " = 10 " Vertical

FIGURE B-5



STILES RESERVOIR DAM
PLAN REDUCED FOR THIS REPORT

TOWN OR CITY	Leicester	DECREE NO.	STORAGE	PLAN NO.	Flood	DAM NO.	25-07
LOCATION	Stiles Reservoir - Storage = 201,000,000 Cu. Ft.					C. C. DOCKET NO.	
DESCRIPTION OF DAM				DESCRIPTION OF RESERVOIR & WATERSHED			
Type	Granite Block Earth Embankment			Name of Main Stream			
Length	675.0			" " any other Streams			
Height	27.0 at waste gate invert.			Length of Watershed			
Thickness top	26.0 to 32.0 - abt. 32' but 40'			Width " "			
" bottom	71.0 to 77.0			Is Watershed Cultivated			
Downstream Slope	Large granite blocks stepped - 1/2:1			Percent in Forests			
Upstream	1:1 riprap			Steepness of Slope			
Length of Spillway	49.5 - width crest 48'			Kind of Soil			
Size of Gates	waste only - 24" c.i. pipe El. 75.2			No. of Acres in Watershed			
Location of Gates	313' to North of spill section.			" " " Reservoir			
Flashboards used	None			Length of Reservoir			
Width Flashboards or Gates	-			Width " "			
Dam designed by	-			Max Flow Cu. Ft. per Sec.			
" constructed by	-			Head or Flashboards-Low Water			
Year constructed	-			" " " High "			
GENERAL REMARKS				GENERAL REMARKS			
Owned by Stiles Reservoir Co. Write David N. Tatt-Oxford. Oxford, Mass. Inspected 9-15-23 L.O.M. See Notebook (3 - P. 32) Maynard, Stetth. Inspected: Oct. 4, 1925. L.O. Marden July 1926. To Carlton Woollen Mills, Inc. Roxbury. Plant filed in Book of Dam Plans March, 1928. Hooper. 60' 4" crest. 5' 0" abutment				- David N. Tatt - Oxford Storage. Inspected: July 18, 1928. L.O. Marden } Am. A.H. Jealous } W.B. Knowlton } Co. Jan 21, 1928 L.O. M. 23, / " FEP, RNF May 13, 1929 " Aug. 26, 1932 " Sept. 25, 1934 " Aug. 15, 1936 - " (over)			

Inspected: Oct. 10, 1938 - L. H. Spofford
Patrol : Mar. 16, 1939 - W. O. Lindquist.
Inspected : Dec. 10, 1940 - L. H. Spofford
" : Mar. 19, 1941 - L. O. M.
" : Dec. 9, 1942 - L. H. Sparty
" : Feb. 23, 1943 - L. H. Spofford
" : Sept. 16, 1943 - L. O. M. WOL
" : Dec. 10, 1945 - M. F. H.

Mar. 20, 1951 - L. O. M.
Mar. 30, 1953 - J. A. H.

Plans Dec 2 1955 L. O. M. WOL (BK 3 Pg 33)
Survey Jan 18, 1956 RST, JAH, SRT, PPP - BK 242 Pg 141
" Sept 10 1956 Tokarz, Jolda, Martak, O'Connell - BK 242 Pg 157.

Spillway Plans Oct 22, 1957 L. O. M. WOL - BK 242 Pg 160.
Survey - Parker St - below spillway - 1959 SH, LHS, PPP - BK 314 Pgs 101 to 109
Measurements - Emb & Ward Spillway - Mar 2 1956 WOL, SRT - BK 3 Pgs 79-80

Inspected Dam: 25-07 - June 27, 1962 with Elmer W. Latham M.M. Carlton Woollen Co.
OWNER - STILES RESERVOIR TRUST - EDWARD F. LEVEEN, JR. TRUSTEE
40 CARLTON WOOLEN MILLS, INC., STAFFORD ST., LEICESTER, MASS
CARTAKER - MR. ELMER W. LATHAM

Commonwealth of Massachusetts

Worcester, S.S.

At a meeting of the County Commissioners of the County of Worcester, begun and
held at Worcester, within and for said County, on the First Tuesday
of September, A.D. 1955, being the 6th day of September
A.D. 1955, at which meeting were present:

Joseph A. Aspero
Edward P. Bird
WORCESTER COUNTY COMMISSIONERS

ORDERED by said County Commissioners that an order
be drawn up for the alterations and repairs necessary to be made
to a dam owned by the STILES RESERVOIR CORPORATION, Att: Mr. Harry
Siff, President, Stiles Reservoir Corporation, c/o Associated
Industries, Webster, Massachusetts; said dam is located on Barton
Brook in the town of Leicester, Massachusetts.

Joseph A. Aspero
Chairman

Edward P. Bird
WORCESTER COUNTY COMMISSIONERS

No. DAM NO. 25-07

ORDER ISSUED TO STILES RESERVOIR
CORPORATION FOR ALTERATIONS AND
REPAIRS TO A DAM ON BARTON'S
BROOK IN LEICESTER, MASSACHUSETTS.

STILES RESERVOIR DAM

COMMISSIONER'S RETURN

SEPTEMBER Meeting

Filed. September 6, A. D. 1955

Attest, Arthur H. Sheedy,

Ast. Clerk.

B-9

A true copy!

Attest!

Arthur H. Sheedy
Ast. Clerk

SPILLWAY:

The washed out stone step apron of the spillway will be replaced. The two abutment walls will be reconstructed. The spillway will be widened in accordance with letter sent you on August 26, 1955 relative to plans and specifications for reconstruction of dams removed by the flood of August 19, 1955.

Your consulting engineer shall confer with the Massachusetts Department of Public Works, Division of Waterways, 100 Nashua Street, Boston, Massachusetts regarding the size of the cross section opening of the spillway for this dam as specified in Chapter 513 of the Acts of 1939. The Division of Waterways shall if the opening is correct give your engineer a certificate so that he can proceed to complete the plan and specifications for the reconstruction of this spillway.

EMBANKMENT:

Water is leaking in several places through the embankment. The water shall be drawn down in the Reservoir so that the location of these leaks throughout the embankment may be found by the use of analine dyes.

The sand bags placed on the embankment after the flood of August 19, 1955 shall be removed and a selected earth fill shall be laid in layers in their place. The leaks shall be traced through the dam and removed by the use of a layer of concrete placed on the upstream side of fill as specified by Engineer.

The upstream embankment slope shall be flattened to 2 1/2: 1; the present slope cleaned off, and interlocking sheet piling shall be driven as directed by the Engineer, and selected earth fill placed in 6" layers 10" thick. Rip rap shall be placed 8 feet below the top of the embankment on the upstream side and to its top.

STILES RESERVOIR DAM

Said embankment shall be raised at least one foot higher than the present gravel fill placed by the town of Leicester. The top of the abutment of the spillway should be raised to equal the elevations of this fill.

The gate shall be inspected and new timbers, gate frame, gate or stem shall be installed if found necessary. A modern hoisting apparatus shall be placed on the gate frame.

The reconstruction of the spillway shall be completed by November 1, 1955.

The repairs to the embankment should be completed by December 1, 1955.

And the owners of said dam are hereby ENJOINED and ORDERED not to allow any water in said Reservoir until the aforesaid alterations and repairs are made to said dam.

If the owner refuses or neglects to make the above alterations and repairs as ordered above, the County Commissioners in accordance with section 47 of Chapter 253 of the General Laws, may at the expense of the County cause said dam to be altered and repaired as ordered above, or the water draw off, whichever they may consider necessary for the safety of life, property, roads or bridges on streams below. The Commissioners may further make such orders as they may deem just as to the payment by the owner of the costs and expenses incurred by them in case the owner refuses or neglects to make such alterations or repairs, said costs and expenses to be ordered paid by the owner with interest from the time they were paid by the County (Section 48 of Chap. 253 of the General Laws).

Joseph A. Aspin

Chairman

Edward P. Biral

LEICESTER COUNTY COMMISSIONER

STILES RESERVOIR DAM



COMMONWEALTH OF MASSACHUSETTS
Worcester County Commissioners

COURT HOUSE, WORCESTER, MASSACHUSETTS

TELEPHONE PLEASANT 6-2441

JOSEPH A. ASPERO, WORCESTER, CHAIRMAN
FRANCIS E. CASSIDY, WEBSTER
EDWARD P. BIRD, FITCHBURG

August 15, 1956

John A. Volpe, Commissioner
Massachusetts Department of Public Works
100 Nashua Street
Boston, Massachusetts

Re: Stiles Reservoir Dam, Leicester, Massachusetts.

Dear Sir:

We have been deluged with inquiries and complaints from residents of Worcester and surrounding areas who have summer homes on Stiles Reservoir, as well as by the residents of the town, who feel that the County Commissioners are responsible for the delay in rebuilding a new Stiles Reservoir Dam. We have also had inquiries from mill owners who are disturbed about the situation, and the possibility of closing down their mills because the water level is now quite low.

It is getting to be a rather serious situation, and we have been holding off sending these people with their complaints to your office since we have felt that it is to our mutual advantage and interest to get this situation straightened out; in fact, the present situation is very likely to develop into a serious catastrophe if we should suddenly get an extreme downfall of rain. Now that we have plans drawn by the Worcester County Engineering Department, (a copy of which is in your office), and which appears to meet with the approval of all parties concerned, it would seem advisable that we arrange a conference in Boston, if possible, and we will get the Attorney for the Stiles Reservoir Corporation to attend. We all here are extremely worried about the responsibility in case anything serious does develop and it would be well we feel, to get the reconstruction of this dam completed by the early part of this fall.

Will you please let me hear from you at once if a conference to resolve this matter can be arranged.

Very truly yours,

WORCESTER COUNTY COMMISSIONERS

Joseph A. Aspero
Joseph A. Aspero, Chairman

W. McKinnon, Chief Engineer (100-100)
W. G. Giff, Hyatt & Giff (100-100)
Bassette, Director (100-100)



LESLIE O. MARDEN
COUNTY ENGINEER

COMMONWEALTH OF MASSACHUSETTS

WORCESTER COUNTY ENGINEERING DEPARTMENT

COURT HOUSE, WORCESTER, MASSACHUSETTS

TELEPHONE WORCESTER 6-2441

January 24, 1957

*Have made progress
rough draft of letter
on subject of
last paragraph*

Board of County Commissioners
Court House
Worcester, Massachusetts

Re: Stiles Reservoir Dam - No. 25.07 - Leicester.

Gentlemen:

Eighteen months have elapsed since the 1955 hurricane. The stepped stone apron of this dam was washed out by the hurricane, and the dam was left in a weakened condition.

The United States Army Engineering Corps rebuilt this apron and the spillway. The spillway, however, will have to be enlarged to handle future flood flows. Mill owners below this dam on the French River own shares of stock in the Stiles Reservoir Corporation.

Mr. Edward Leveen, Manager of the Carleton Woolen Company, Rockdale, has spent about \$3500.00 of its' firms money to make repairs to the embankment of the dam.

Mr. Leveen called yesterday and told me that he will complete the repairs to the dam if the other stockholders will turn their stock over to him. So far, only Textron Inc., Krintman, and H. & V. Specialties have stated they would give him their stock. Mr. Harry Siff made no reply.

Section 45 of the General Laws, Chapter 253 and amendments thereto states in part: "Every examination shall be made by a competent engineer who shall report to the commissioners in writing whether he considers the structure safe and in good condition, and if not, its condition in detail and the work or the changes required for safety and the public good."

Section 47 states in part: "If, after notice in writing to the owner of a reservoir or dam which has been examined, the said owner refuses or neglects to make such repairs as the commissioners order, they may, at the expense of the county, cause such reservoir or dam to be altered and repaired or any part thereof removed or the water drawn off, whichever they may deem or necessary for the safety of life, property, and health on the stream below."

Cont'd.

2. County Commissioners

January 24, 1957

Section 48 states "The commissioners shall make such orders as they may deem just as to the payment by the owner, county or other party of the costs and expenses incurred by them under the three preceding sections, and if the reservoir or dam was adjudged to be unsafe, said costs and expenses may be ordered paid by the owner, with interest, from the time they were paid by the county."

It is my opinion that a letter should be sent to each stockholder of the Stiles Reservoir Corporation that these alterations must be made in accordance with the above General Laws.

Very truly yours,

WORCESTER COUNTY ENGINEERING DEPT.

L. O. Marden
L. O. Marden, County Engineer

LOM:es

STILES RESERVOIR DAM

INSPECTION REPORT - DAMS AND RESERVOIRS

1. Location: City/Town LEICESTER Dam No. 3-14-151-07

Name of Dam STILES Reservoir Inspected by W. REGAN

Date of Inspection 7/4/76

2. Owner/s: per: Assessors _____ Prev. Inspection _____

Reg. of Deeds _____ Pers. Contact ☒

1. CHARLTON Woolen Mills Inc., STAFFORD St. Leicester MASS.

Name _____ St. & No. _____ City/Town State Tel. No. _____

(Stiles Reservoir TRUST. Ed LAVERN - TRUSTEE)

2. Name _____ St. & No. _____ City/Town State Tel. No. _____

3. Name _____ St. & No. _____ City/Town State Tel. No. _____

3. Caretaker (if any) e.g. superintendent, plant manager, appointed by absentee owner, appointed by multi owners.

Name: _____ St. & No.: _____

City/Town: _____ State: _____ Tel.No.: _____

4. No. of Pictures taken _____

5. Degree of Hazard: (if dam should fail completely)*

1. Minor _____ 2. Moderate ☒

3. Severe _____ 4. Disastrous _____

* This rating may change as land use changes (future development)

6. Outlet Control: Automatic _____ Manual ☒

Operative ☒ yes; _____ No.

Comments: Mod. to heavy leakage Around but not Through North Set of Sluices Indicates more of a Problem than just No. Seating of Gater. Some Silt transported (deposits)

7. Upstream Face of Dam: Condition: Visible but leakage visibly Clear

1. Good ☒ 2. Minor Repairs _____

3. Major Repairs _____ 4. Urgent Repairs _____

on Comments: RIP RAP & TURF IN Very good

Condition - No growth of Trees, brush on U.S. Face

Downstream Face of Dam:

Condition: 1. Good _____ 2. Minor Repairs ☒ _____
 3. Major Repairs _____ 4. Urgent Repairs _____

Comments: Remove Trees & brush. No leakage
 Through main embankment Noted except
 as described in (6) & (12) (at Gates & Spillway)

9. Emergency Spillway:

Condition: 1. Good _____ 2. Minor Repairs ☒ _____
 3. Major Repairs ☒ _____ 4. Urgent Repairs _____

Comments: *UPPER level - U.S. End South Cheekwall Cracked -
 at High water level*

10. Water Level at time of inspection: _____ ft. above _____ below _____
 top of dam _____ ^{AT} principal spillway INVERT
 other _____

11. Summary of Deficiencies Noted:

Growth (Trees and Brush) on Embankment ☒ - Downstream Slope only

Animal Burrows and Washouts _____

Damage to slopes or top of dam _____

Cracked or Damaged Masonry ☒ So. Cheekwall (See 9)

Evidence of Seepage ☒ _____

Evidence of Piping _____

Erosion _____

Leaks ☒ _____

Trash and/or debris impeding flow _____

Clogged or blocked spillway _____

Other _____

Remarks & Recommendations: (Fully Explain)

The main embankment is in generally in very good condition. There are some trees & brush on the d.s. slope. Only slight dampness was noted at the downstream toe.

The upstream side of the South Spillway Checkwall has a Vertical 1"± wide Crack, and at the downstream side of this Checkwall adjacent to the intersection of the Checkwall and Sluice Tailwall a Vertical Crack was noted - Approx 1/3± c.y. Cavity Noted behind this Crack. Apparently at higher Pool elevation water enters the U.S. Crack, flows through the embankment behind the South Checkwall to the lower d.s. Crack causing embankment material to wash. If not corrected cavity will enlarge & progress toward U.S. Crack. There is heavy leakage through the North gates - Very small flow through the Sluice pipes; heavy

(Continued on 3A)

13. Overall Condition:

1. Safe _____
2. Minor repairs needed _____
3. Conditionally safe - major repairs needed ☒ _____
4. Unsafe _____
5. Reservoir impoundment no longer exists (explain)
Recommend removal from inspection list _____

STILES RESERVOIR DAM

(3A)

Dam No. 3-14-151 - 07

leakage emerges from the toe of the tailwall. The discharge is visibly clear, but large deposits of obviously transported material were noted downstream.

The owner should retain a Consultant engineer experienced in dam work to trace out these percolation paths and prepare application, for plans etc. for rectification of this condition.



The Commonwealth of Massachusetts

EXECUTIVE OFFICE OF ENVIRONMENTAL AFFAIRS
DEPARTMENT OF ENVIRONMENTAL QUALITY ENGR.
DIVISION OF WATERWAYS

100 Nashua Street, Boston 02114

November 8, 1976

Charlton Woolen Mills, Inc.
Stafford Street
Leicester, Massachusetts

RE: Inspection Dam #3-14=151-07
Stiles Reservoir Dam
Leicester

Gentlemen:

On July 9, 1976, an Engineer from the Massachusetts Department of Public Works made a visual inspection of the above dam. Our records indicate the owner to be Stiles Reservoir Tr., Ed Lareen, Tr. If this information is incorrect, will you please notify this office.


The inspection was made in accordance with the provisions of Chapter 253 of the Massachusetts General Laws as amended (Dams Safety Act). Chapter 706 of the Acts of 1975 transferred the jurisdiction of the so-called "Dams Safety Program" to the Commissioner of the Department of Environmental Quality Engineering.

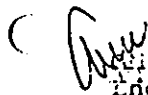
The results of the inspection indicate that this dam is conditionally safe. The following conditions were noted that require attention:

The District Dams Engineer, Mr. Willis Regan, recommends that this dam receive a consultant inspection. Enclosed is an application form which should be filled out and mailed to the above address.

We call these conditions to your attention before they become serious and more expensive to correct. With any correspondence please include the number of the dam as indicated above.

Very truly yours,


John A. Hannon, F.E.
Chief Engineer


Enclosure
cc: J.J. Lyons
W. Regan
Leicester, Selectmen

June 15, 1977

Mr. Willard Regan
Department of Internal Affairs
Commonwealth of Massachusetts
403 Belmont Street
Worcester, MA 01605

Dear Sir:

I have been requested, as Town Counsel for the Town of Leicester, to examine and make recommendations to the Selectmen relative to the lowering or controlling of the water level at the Burncoat Pond, Stiles Reservoir and Cedar Meadow Lake in the Town of Leicester.

Today I have conferred with Mr. William Griffin, Chairman of the Town Conservation Commission, Mr. Terence Finan, Executive Secretary of the Board of Selectmen and Mr. Raymond Shea, who has succeeded to the property interest of the Carlton Woolen Mills.

We have been advised by Mr. Shea that your office has authorized Mr. Shea to lower the dam at Burncoat in order to effect repairs which were recommended by you following an inspection in August of 1976. We are further advised that, within the past week, you have orally advised Mr. Shea that these repairs are presently in order and that you made specific recommendations relative to additional repairs.

Mr. Willard Regan
Department of Internal Affairs
June 15, 1977
Page Two.

The current posture of the situation is that the dam has been lowered and a quantity of water has left the Pond. This has been represented by Robert Tivnan, representing a coalition of property owners, to be about fifteen and one-half inches.

Today, Mr. Shea has voluntarily agreed to raise the dam to prevent further loss of water.

It becomes apparent that all parties, for various reasons, must know the current degree of hazard at the dam.

Accordingly, we respectfully ask that your Division conduct an immediate inspection of the dam and make an appropriate report.

This request is made by the Board of Selectmen and by the Conservation Commission, as well as Mr. Shea.

We would greatly appreciate your immediate attention to a situation which we consider to have some urgency.

Very truly yours,

ROBERT V. MULKERN,
Town Counsel

smm

pc: State Water Control Commission
Mr. Edward Hannon, Chief Engineer,
Office of Environmental Affairs
Board of Selectmen, Town of Leicester
Raymond Shea
Robert Tivnan
William Griffin, Chairman, Conservation Commission

INSPECTION REPORT - DAMS AND RESERVOIRS

1. Location: City/Town LEICESTER Dam No. 3-14-151-07

Name of Dam STILES Reservoir, Inspected by W. REGAN

Date of Inspection 6/17/77

2. Owner/s: per: Assessors _____ Prev. Inspection _____

Reg. of Deeds _____ Pers. Contact Telephone ☒

1. RAYMOND E. SHEA CENTRAL NEW England REALTY,
Name _____ St. & No. _____ City/Town State Tel. No. _____

2. 44 PARK AVE. WORCESTER
Name _____ St. & No. _____ City/Town State Tel. No. _____

3. _____
Name _____ St. & No. _____ City/Town State Tel. No. _____

3. Caretaker (if any) e.g. superintendent, plant manager, appointed by absentee owner, appointed by multi owners.

Name: _____ St. & No.: _____

City/Town: _____ State: _____ Tel. No.: _____

4. No. of Pictures taken 0

5. Degree of Hazard: (if dam should fail completely)*

1. Minor _____ 2. Moderate _____

3. Severe ☒ 4. Disastrous _____

* This rating may change as land use changes (future development)

6. Outlet Control: Automatic _____ Manual ☒

Operative _____ yes; ☒ No.

Comments: see 12

7. Upstream Face of Dam: Condition:

1. Good ☒ 2. Minor Repairs _____

3. Major Repairs _____ 4. Urgent Repairs _____

Comments:

8. Downstream Face of Dam:

Condition: 1. Good ✓ 2. Minor Repairs _____
3. Major Repairs _____ 4. Urgent Repairs _____

Comments: Embankment Appears To be in very good Condition

9. Emergency Spillway:

Condition: 1. Good _____ 2. Minor Repairs _____
3. Major Repairs ✓ 4. Urgent Repairs _____

Comments: Water Piping Through Spillway's South Cheekwall, emerges @ Lower Elevation from hole at the intersection of d.s. End of Cheekwall & D.S. Wing Wall - Penetrated this hole to a depth of 5' ± length of this cavity probably greater than this. Probably couldn't penetrate further because of convoluted alignment.

10. Water Level at time of inspection: 0.1 ± ft. above ✓ below _____
top of dam _____ principal spillway crest
other _____

11. Summary of Deficiencies Noted:

Growth (Trees and Brush) on Embankment _____
Animal Burrows and Washouts A few small burrows noted on d.s. Slope
Damage to slopes or top of dam _____
Cracked or Damaged Masonry ✓
Evidence of Seepage ✓
Evidence of Piping ✓
Erosion _____
Leaks ✓
Trash and/or debris impeding flow _____
Clogged or blocked spillway _____
Other _____

12. Remarks & Recommendations: (Fully Explain)

The Conditions Noted in (12) on my 7/9/76 inspection report prevail. The condition noted at (9) should be corrected as soon as possible. A more serious condition was noted at the Northerly Sluice gate discharge. There is a trickle flow through the 2 A.C.C.M. Sluice Pipes, but there is a high velocity flow emerging at 2 locations from the toe of the Tailwall. Silt deposits are located on the contiguous section of streambed.

Mitigating factors are:

- ① The discharge is clear
 - ② These conditions have prevailed for at least one year with visible deterioration progressing only to a minor degree
 - ③ The main embankment is in very good condition
- Given the high hazard rating of this dam (1 1/2 billion gallons passing 3 well developed areas & the MASS Turnpike) I would recommend that the owner immediately retain a Consulting Engineer experienced in dam restoration. This same owner owns Dams # 08, 09 ^{Leicester} which also need a Consultant inspection.

13. Overall Condition: Needs a Consultant inspection and a P.S. & E. For Restoration

1. Safe _____
2. Minor repairs needed _____
3. Conditionally safe - major repairs needed _____
4. Unsafe _____
5. Reservoir impoundment no longer exists (explain) _____

Recommend removal from inspection list _____

Due to the situation at the Northerly gates, I would recommend ^{Preferential} use of the Southerly gate

DEPARTMENT OF
ENVIRONMENTAL QUALITY ENGINEERING
DIVISION OF WATERWAYS
DESCRIPTION OF DAM

RECEIVED JUN 21 1977

DISTRICT 3

Submitted by W. REGAN Dam No. 3-14-151-07

Date 6/20/77 City/Town LEICESTER

Name of Dam Stiles Reservoir

1. Location: Topo Sheet No. 21A - Leicester Quad.

Provide 8 $\frac{1}{2}$ " x 11" in clear copy of topo map with location of
Dam clearly indicated.

2. Year built: 1923 Year/s of subsequent repairs N/A

3. Purpose of Dam: Water Supply _____ Recreational _____
Irrigation _____ Other originally M.L.L. Storage

4. Drainage Area: 4 sq. mi. _____ acres

5. Normal Ponding Area: 400³⁶⁰ acres; Ave. depth _____
Impoundment: 201,000,000 gal.; _____ acre ft.

* 6. No. and type of dwellings located adjacent to pond or reservoir
_____ i.e. summer homes, etc. >100 Year Round dwellings

7. Dimensions of Dam: Length 700' ± Max. Height 27'

Slopes: Upstream Face 1:1 - Riprap

Downstream Face 26' - 32'

Width across top 26' - 32'

8. Classification of Dam by Material:

Earth ☒ Conc. Masonry _____ Stone Masonry ☒

Timber _____ Rockfill _____ Other _____

9. A. Description of present land usage downstream of dam:

80 % ^{Residential} rural; 20 % urban & Light & Med. Industry

B. Is there a storage area or flood plain downstream of dam which
could accomodate the impoundment in the event of a complete
dam failure? yes _____ no ☒

*NOTE (6): According to The Chairman of The Leicester
Cons. Comm. Any draw down Could affect adjacent
Gravity wells

10. Risk to life and property in event of complete failure.

See Note .
Below

No. of people _____.
 No. of homes _____.
 No. of Businesses _____.
 No. of industries _____ Type _____.
 No. of utilities _____ Type _____.
 Railroads _____.
 Other dams _____.
 Other _____

11. Attach Sketch of dam to this form showing section and plan on 8½" x 11" sheet.

12. How to Locate: W.B. ON RTE. ²⁰~~56~~ (CHARLTON), TURN Rt. onto Rte 56. Head Northerly for

Note(10): failure discharge passes several MAIN Roads (including MASS TURNPIKE) & through 3 well populated areas (Rosedale, CUMMINSVILLE, North OXFORD) before reaching storage in Cedar SWAMP ≈ 5 mi. downstream. Severe Property damage is certain & loss of life could easily occur.

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DAVIDSON 3-14-151-07

STILES RESERVOIR DAM



The Commonwealth of Massachusetts

EXECUTIVE OFFICE OF ENVIRONMENTAL AFFAIRS
DEPARTMENT OF ENVIRONMENTAL QUALITY ENGR.
DIVISION OF WATERWAYS

100 Nashua Street, Boston 02114

July 18, 1977

Mr. Raymond E. Shea
Central New England Realty Trust
44 Park Ave.
Worcester, Mass.

Re: Inspection Dams #3-14-151-07-Stiles Reservoir Dam
~~#3-14-151-08-Cedar Meadow Pond Dam~~
~~#3-14-151-09-Burncoat Pond Dam~~
Leicester

Dear Sir:

Our records indicate the ownership of the above mentioned dams has changed from Charlton Woolen Mills Inc. to Central New England Realty Trust. If this information is incorrect would you please notify this office.

Each of the above mentioned dams was visually inspected in July & August of 1976. All three dams were rated as only conditionally safe as the result of the inspections. In all three cases the owner (Charlton Woolen Mills Inc.) was notified of this rating, and was sent an "Application for Authorization to Construct or Alter a Reservoir, Reservoir Dam or Mill Dams" to be filled out by a Registered Professional Civil Engineer and returned to this office, we have received no response to this request.

On June 17, 1977 another visual inspection of the three dams in question was made, the conclusions were substantially similar to those derived from the previous inspections. Some indication of routine maintenance was evident but repairs requiring a much more detailed study and analysis appears to be warranted.

Therefore an in depth inspection by a Registered Professional Civil Engineer to make proper recommendations for corrective action is imperative. Please notify this office when you have retained a Registered Professional Civil Engineer.

Raymond E. Shea
Re: Inspection of Dams

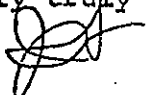
July 18, 1977

- 2 -

Enclosed are the necessary applications which should be filled out by the Registered Professional Civil Engineer retained by you and returned to this office.

Should you need additional information do not hesitate to contact this office.

Very truly yours,


JOHN J. HANNON, P.E.
CHIEF ENGINEER


AMCC:eh

STILES RESERVOIR DAM

APPENDIX C
PHOTOGRAPHS

STILES RESERVOIR DAM



NO. 1 VIEW OF SPILLWAY FROM DOWNSTREAM AREA

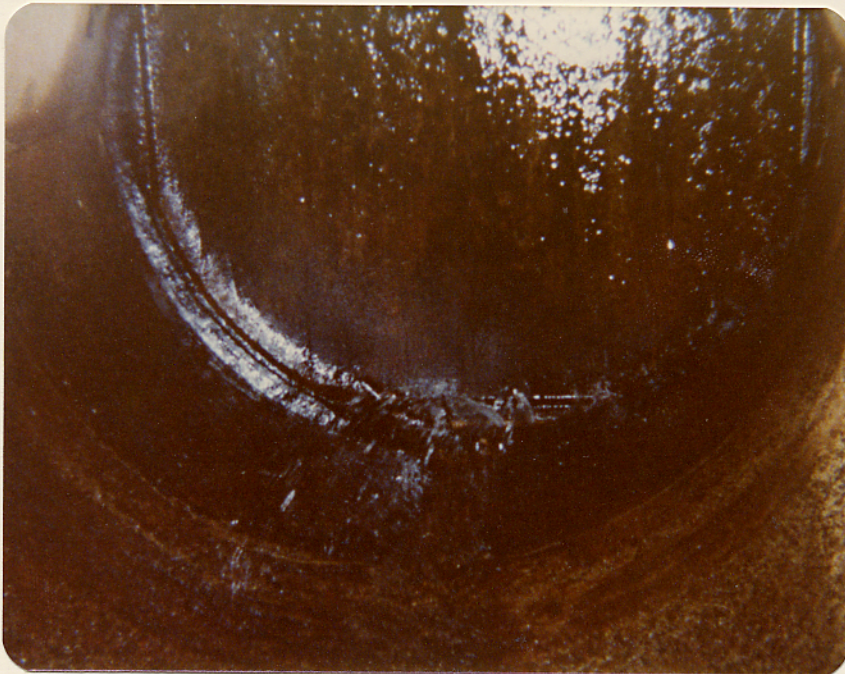


NO. 2 VIEW OF UPSTREAM SLOPE

STILES RESERVOIR DAM



NO. 3 VIEW OF GATED DISCHARGE PIPE AT SPILLWAY



NO. 4 VIEW OF DOWNSTREAM SIDE OF SLUICE GATE AT SPILLWAY

STILES RESERVOIR DAM



NO. 5 VIEW OF DISCHARGE AT OUTLET PIPE



NO. 6 VIEW OF DISCHARGE IN VICINITY OF OUTLET PIPE

STILES RESERVOIR DAM

APPENDIX D
HYDROLOGIC AND HYDRAULIC
COMPUTATIONS

	<u>Page</u>
Figure D-1 Drainage Area - Stiles Reservoir	D-1
Hydrologic and Hydraulic Computations	D-2

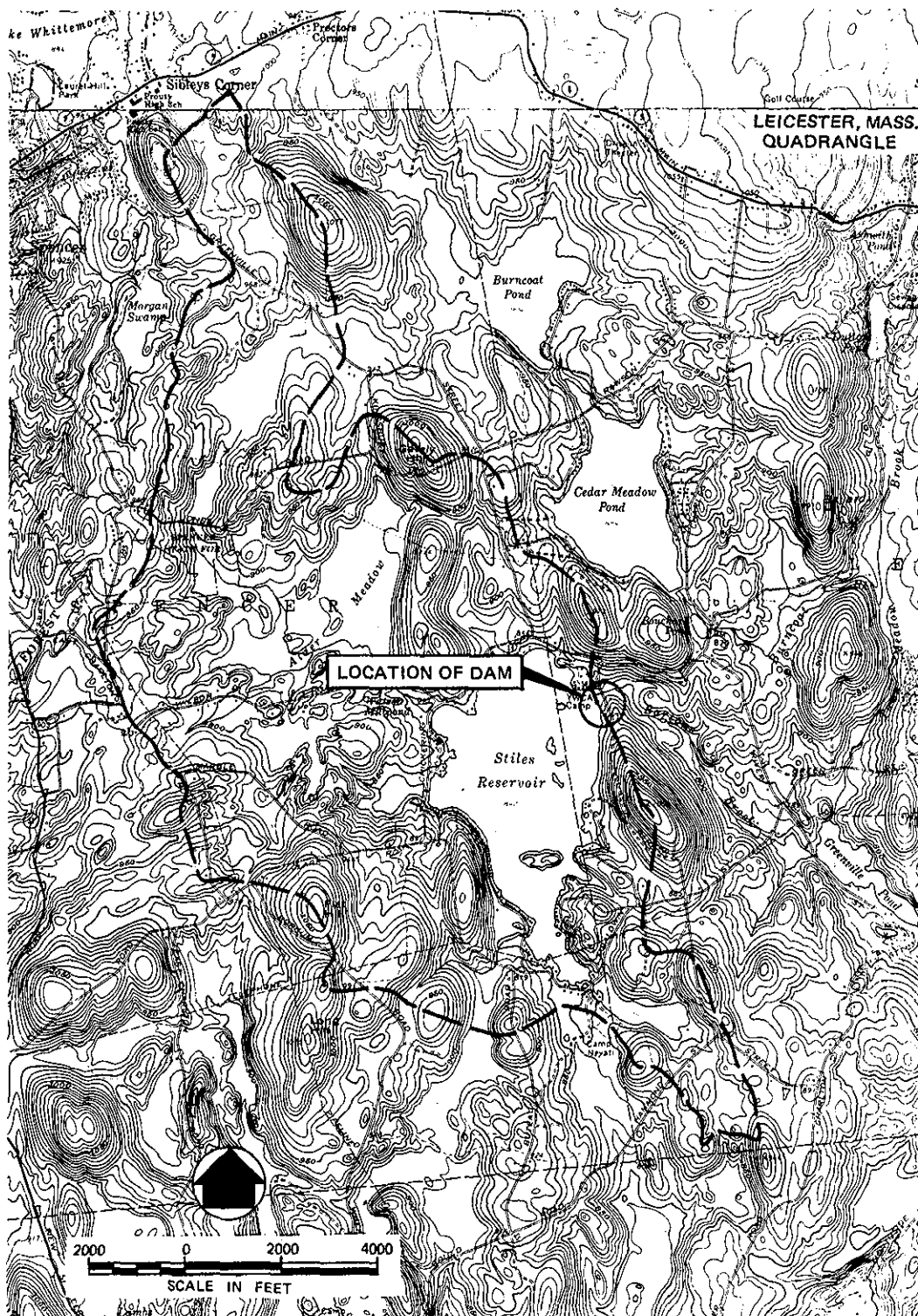


FIG. D-1 DRAINAGE AREA MAP – STILES RESERVOIR

I Test Flood, Storage & Storage Functions

1- Total Drainage Area - 4.49 mi²

2- Pond(s) Area: 0.51 mi²
 Swamp(s) Area: 0.07 + 0.04 + 0.27 + 0.04 + 0.03 = 0.45 mi²
 Total Area Pond(s) & Swamp(s): 0.96 mi²

% Ponds & Swamps = $\frac{0.96}{4.49} = 21\%$

3- $\frac{1075 - 842}{.15600} = 1,014.9$ } Say Ave Slope = 1.5%

4- Using C. of E. Curves for Peak Flow Rates & above guide values the Peak Flow Rate was estimated to be slightly above. "Flat & Coastal" and taken at 950 c.f.s./mi²
 Size Class: Interm.; Hazard Pot.: HIGH; Spill. Des. Flood: Full PMF
 Use: Test Flood = Full PMF

5- Test Flood Inflow = (950) 4.49 = 4300 c.f.s.

6- Pond Storage

The pond area is 0.51 sq. mi. at elev. 842
 Based on a const. area, storage increases at 326 ac. feet per foot of depth increase.
 At pond elev. 846, 1304 ac.ft is stored above the spillway crest

7- Storage Functions are based on $Q_{out} = Q_{in} [1 - \frac{S_{out}}{R}]$

S_{out} = Storage Vol. in Reservoir related to final Q_{out} in terms of inches of rain over the drainage area.

$S(\text{in Inches}) = 12 D \left(\frac{0.51}{4.49} \right) = 1.36 D$; $R = 6 \text{ hr rain of } 5 \text{ in}$

D = Storage Depth (above spillway) on reservoir, in feet.

8- Storage Functions: (F_{TF}) ; $D = 0$ @ Pond El. 842

$F_{TF} = 4300 - 226 S = 4300 - 308 D$

II Discharge Rating

A - Spillway

Length - 50' ; Crest - sm. ogee ; Crest el. 842, No Flash barrier Used

$$\text{Use: } Q_s = C L H_s^{1.5} = 4 \times 50 \times H_s^{1.5} = 200 H_s^{1.5}$$

Pond El.	843	844	845	845.6	846	847	848
H_s	1	2	3	3.6	4	5	6
Q_s	200	570	1040	1370	1600	2240	2940

B - Southerly Outlet Pipe

Size 60" ϕ , Gate on entr. face of pipe, Distr. ℓ elev. 834.9

$$H_p = \frac{V_p^2}{2g} (2) [\text{entr.} + \text{exit} + (\text{frict.})] \therefore Q_p = 19.6 V_p = 19.6 (5.67) H_p^{1/2} = 111.2 H_p^{1/2}$$

Pond El.	843	844	845	845.6	846	847	848	841.5
H_p	8.1	9.1	10.1	10.7	11.1	12.1	13.1	6.6
Q_p	320	340	350	360	370	390	400	285

C - Crest Flow

$$\text{Use } q_c = 2.55 (H_c)^{1.5} \quad [\text{Ref.: V.T. Chow: "Op. Chan Hydr" pp 52-53}]$$

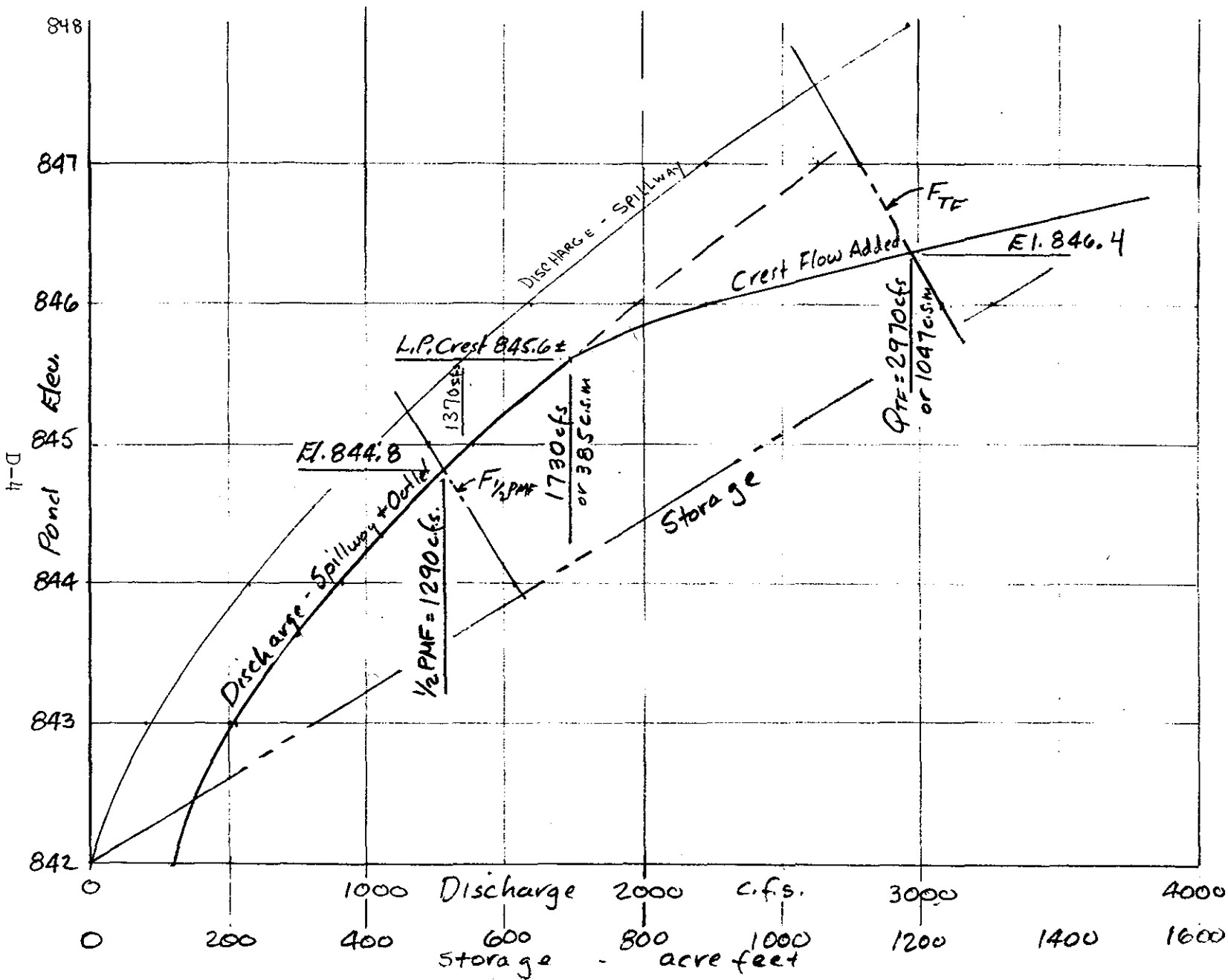
$$\text{lengths: } 400' @ 845.6 \text{ for } Q_1 = 1020 (H_{c1})^{1.5} \\ 170' @ 846.7 \pm \text{ for } Q_2 = 433.5 (H_{c2})^{1.5}$$

Pond El.	846	847	848
Q_1	260	1690	3790
Q_2	—	70	640
Tot. Q_c	260	1760	4430

D - Time to lower Pd from 842 to 841 using southerly outlet -

$$\text{Time} = \frac{320(43560)}{285(3600)} = 13.8 \text{ hours}$$

Note: Central outlet pipe not presently operative.



III Discharge, Storage & Storage Function vs Pond Elevation

Project	Nat. Review of Non Fed. Dams	Acct. No.	6191	Page	3	of	5
Subject	Worcester Mass. Area	Comptd. By	L.E.B.	Date	12/14/78		
Detail	STILES RESERVOIR	Ch'd. By	g.e.k.	Date	10 DEC 1978		

④ Crest Flow

$$\text{Elev. for } Q_{TF} = 846.35$$

$$\text{" L.P. Crest } = 845.6$$

$$\text{Max "Head" on Crest } = 0.75$$

$$Q_c = 2.55(0.75)^{1.5} = 1.66 \text{ cfs/ft.}$$

As Critical Flow:

$$y_c = 0.44' , V_c = 3.8 \text{ fps.}$$

⑤ LOW LEVEL DISCHARGE 24 INCH PIPE

ASSUME LOW LEVEL OUTLET OPERABLE

$$H_p = \frac{V_p^2}{2g} (3) [\text{ent} + \text{exit} + \text{frict}] \quad \phi \text{ outlet} = 818$$

$$Q_p = 3.14 V_p = 3.14 (4.63) H_p^{1/2} = 14.5 H_p^{1/2}$$

WITH WS = 843 (1 ft above spillway crest)

$$Q_p = 14.5 (843 - 818)^{1/2} = 72.5 \text{ cfs}$$



Failure of Dam

Peak Failure Flow:

Pond Elevation - 845.6 (L.P. on Crest)

Toe Elevation - 820.0± (Slightly above outlet pipe)

$$Y_0 = 25.6$$

Dam Length Subject to Breaching = 400

$$W_0 = 40\%(400) = 160$$

$$Q_{P1} = 1.68 W_0 (Y_0)^{1.5} = 1.68 (160) (25.6)^{1.5} = 34800 \text{ cfs}$$

$$Q_{P2} = 1.68 (160) (25.6)$$

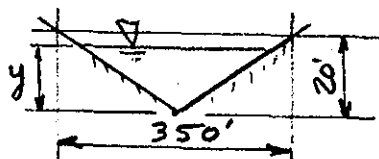
Storage Volume Released:

$$\text{Storage Above Spillway } 3.6 \times 326 = 1174 \text{ ac. ft.}$$

$$\text{Storage Below Spillway } 326 \times \frac{1}{3} \times 22 = 2390 \text{ " "}$$

$$S = \text{Total Storage} = 3564 \text{ " "}$$

Channel Hydraulics:



$$S = \frac{30}{2000'}; n = 0.08, R \approx \frac{1}{2} y$$

$$V = 2.28 R^{2/3} = 1.44 y^{2/3}, A = \frac{1}{2} (17.5) y^2$$

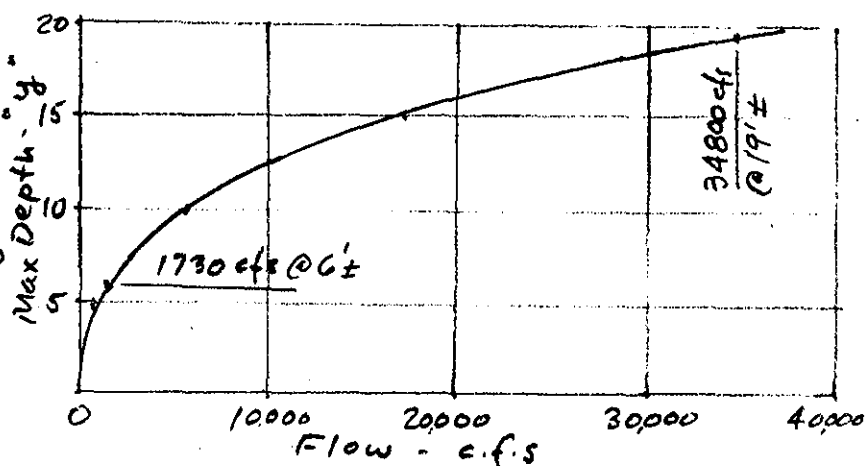
y	A	V	Q
5'	219	4.25	920
10'	875	6.7	5840
15'	1970	8.7	17200
20'	3500	10.6	37100

$$\text{Trial } Q_{P2} = 34800 \left(1 - \frac{638}{3564}\right) = 28570$$

$$y_2 \approx 18'$$

$$\text{Final } y = 18.5', Q_{P2} = 30,000 \text{ cfs}$$

$$\text{Vel.} = 10 \text{ fps}$$



Time to Drain:

$$\frac{43560 (3564)}{3600 (\frac{1}{2}) (34800)} = 2.5 \text{ Hours, or 149 minutes}$$

APPENDIX E

INFORMATION AS CONTAINED IN THE
NATIONAL INVENTORY OF DAMS

STILES RESERVOIR DAM



INVENTORY OF DAMS IN THE UNITED STATES

STATE	IDENTITY NUMBER	DIVISION	STATE	COUNTY	CONGR. DIST.	STATE	COUNTY	CONGR. DIST.	NAME	LATITUDE (NORTH)	LONGITUDE (WEST)	REPORT DATE
MA	083	FED	MA	27	03				STILES RESERVOIR DAM	4213.0	7156.6	28NOV78

POPULAR NAME	NAME OF IMPOUNDMENT
	STILES RESERVOIR

REGION	Basin	RIVER OR STREAM	NEAREST DOWNSTREAM CITY-TOWN-VILLAGE	DIST FROM DAM (MI.)	POPULATION
01	06	FRENCH RIVER	ROCKDALE	3	1500

TYPE OF DAM	YEAR COMPLETED	PURPOSES	STRUCTURAL HEIGHT (FT.)	HYDRAULIC HEIGHT (FT.)	IMPOUNDING CAPACITIES		DIST	OWN	FED	R	PRV/FED	SCS	A	VER/DATE
					MAXIMUM (ACRE-FT.)	NORMAL (ACRE-FT.)								
REGULG	1865	S	29	29	3100	2700		N		N		N		21FEB79

REMARKS

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	
D/S HAS	SPILLWAY			MAXIMUM DISCHARGE (FT.)	VOLUME OF DAM (CY)	POWER CAPACITY		NAVIGATION LOCKS							
	CREST LENGTH	TYPE	WIDTH (FT.)			INSTALLED (MW)	PROPOSED (MW)	NO.	LENGTH (FT.)	WIDTH (FT.)	LENGTH (FT.)	WIDTH (FT.)	LENGTH (FT.)	WIDTH (FT.)	
1	500	U	50	1379	40000										

OWNER	ENGINEERING BY	CONSTRUCTION BY
CENTRAL WATER DISTRICT	UNKNOWN	UNKNOWN

REGULATORY AGENCY			
DESIGN	CONSTRUCTION	OPERATION	MAINTENANCE
NONE	NONE	NONE	NONE

INSPECTION BY	INSPECTION DATE	AUTHORITY FOR INSPECTION
METCALF AND EDDY INC	DAY MO YR 18NOV78	PUBLIC LAW 92-367

REMARKS